AGRISCIENCE TECHNOLOGY II

#01022

Description

Agriscience Technology courses integrate biological and technological concepts with principles of agriculture. Courses are designed in sequences to provide experiences in the subject matter. Units are selected to develop knowledge and skills pertaining to nutrition, reproduction, diseases, breeding, genetics, anatomy, and physiology in animals and plants. Genetic engineering, biotechnology, plant propagation techniques, agricultural production technologies, marketing technologies, aquaculture, animal health, and small animal care are examples of units that may be taught.

These courses integrate leadership and supervised agricultural experience programs. Career opportunities and educational preparation are examined. Learning activities are varied with classroom, laboratory and field experiences.

Note: These courses can be taught for Agricultural Education credit only.

½ to 1 credit
Max credit=1
Grades 9-12

Standard 1	***AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) FOUNDATIONAL PATHWAY SKILLS***	
Topic 1.1	**Research, examine, and discuss issues and trends that impact AFNR systems on local, state, national, and global levels.**	
	Student Competencies	
	1.1.3	Analyze AFNR issues and their impact on local, state, national, and global levels.
	1.1.4	Predict the impact of current trends in AFNR systems on local, state, national, and global levels.
Topic 1.2	**Examine technologies and analyze their impact on AFNR systems.**	
	Student Competencies	
	1.2.3	Demonstrate appropriate use of technologies in AFNR workplace scenarios.
	1.2.4	Analyze how technology is used in AFNR systems to maximize productivity.
Topic 1.4	**Research and use geographic and economic data to solve problems in AFNR systems.**	
	Student Competencies	
	1.4.3	Interpret AFNR related geographic data using a variety of systems and technologies (e.g., GIS, GPS, etc.).
	1.4.4	Evaluate a set of economic data and explain how it impacts an AFNR system.
Topic 1.5	**Examine the impact of AFNR on the local, state, national, and global society and economy.**	
	Student Competencies	
	1.5.4	Examine the impact AFNR systems have on local, state, national, and global society and economy.
	1.5.5	Assess how people on local, state, national, and global levels interact with AFNR systems on a daily, monthly, or yearly basis.
	1.5.6	Assess the economic impact of an AFNR system on a local, state, national, and global level.
Topic 1.6	**Identify and explain the implications of required regulations to maintain and improve safety, health, and environmental management systems.**	
	Student Competencies	
	1.6.3	Explain a health, safety, and environmental procedures to comply with regulatory and safety standards.
	1.6.4	Analyze existing required regulations within an AFNR workplace.
Topic 1.7	**Develop and implement a plan to maintain and improve health, safety, and environmental compliance and performance.**	
	Student Competencies	
	1.7.3	Analyze the effectiveness of health and safety performance plans of an AFNR workplace.
	1.7.4	Prepare plans to improve environmental compliance and performance within an AFNR system.
Topic 1.8	**Apply health and safety practices to AFNR workplaces.**	
	Student Competencies	
	1.8.4	Assess various emergency response plan requirements for an AFNR workplaces and/or facility.

	1.8.5	Discuss first aid knowledge and procedures relevant to AFNR workplaces.
	1.8.6	Select appropriate responses for different levels of contamination or injury at an AFNR workplace.
Topic 1.9	**Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.**	
	Student Competencies	
	1.9.4	Demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
	1.9.5	Demonstrate the set up and adjustment for tools and equipment related to AFNR tasks.
	1.9.6	Demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
Topic 1.10	**Identify and implement practices to steward natural resources in different AFNR systems.**	
	Student Competencies	
	1.10.3	Analyze practices to steward natural resources in AFNR systems (e.g., wildlife and land conservation, soil and water practices, ecosystem management, etc.).
	1.10.4	Categorize sustainability practices that can be applied in AFNR systems (e.g., energy efficiency, recycle/reuse/repurpose, green resources, etc.).
Topic 1.11	**Assess and explain the natural resource related trends, technologies, and policies that impact AFNR systems.**	
	Student Competencies	
	1.11.3	Dissect natural resources trends and technologies impacting AFNR systems (e.g., climate change, green technologies, water resources, etc.).
	1.11.4	Compare natural resources policies impacting current AFNR systems (e.g., for water resources, land use, air quality, etc.).
Topic 1.12	**Evaluate and implement the steps and requirements to pursue a career opportunity in each of the AFNR career pathways (e.g., goals, degrees, certifications, resumes, cover letter, portfolios, interviews, etc.).**	
	Student Competencies	
	1.12.4	Design a personal plan outlining goals and steps to obtain a career in an AFNR pathway.
	1.12.5	Analyze personal skills for attaining a career in an AFNR pathway.
	1.12.6	Communicate personal goals, experiences, education, and skills utilizing specific tools (e.g., resumes, portfolios, cover letters, etc.) and processes (e.g., interviews, applications, etc.) for an AFNR career.
Topic 1.13	**Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest.**	
	Student Competencies	
	1.13.2	Assess how personal skills and align them with potential career opportunities in AFNR pathways.
Topic 1.14	**Examine and explain foundational cycles and systems of AFNR.**	
	Student Competencies	
	1.14.3	Analyze how life cycles affect production, processing, and management of food, feed, fiber, and fuel.
	1.14.4	Analyze the impact of producing and processing food, feed, fiber, and fuel within AFNR systems.
Topic 1.15	**Recognize the value of a Supervised Agricultural Experience (SAE) as Work-Based Learning.**	
	Student Competencies	
	1.15.4	Analyze the value of SAEs.

	1.15.5	Analyze the lifelong learning and career skills that are developed from SAE involvement.
	1.15.6	Categorize projects based on foundational or immersion types of SAEs.
Topic 1.16	**Implement the components of a Foundational SAE.**	
	Student Competencies	
	1.16.6	Create a career plan of study.
	1.16.7	Perform an employability skills self-assessment to determine areas for growth.
	1.16.8	Craft a personal financial plan that supports one's financial goals.
	1.16.9	Analyze situations for workplace safety hazards.
	1.16.10	Research and analyze how issues, trends, technologies, and public policies impact AFNR systems.
Topic 1.17	**Recognize the options within and participate in immersive supervised agricultural experiences.**	
	Student Competencies	
	1.17.3	Create a personal immersion SAE plan to develop the knowledge and skills required to be successful in a specific AFNR career field.
	1.17.4	Choose a record-keeping system to demonstrate financial literacy.
Topic 1.19	**Evaluate the structure and value of agricultural education.**	
	Student Competencies	
	1.19.5	Analyze how the components support one another in the education of students.
	1.19.6	Explain the impact classroom instruction has on student learning.
	1.19.7	Explain the impact FFA has on student learning.
	1.19.8	Explain the impact SAE has on student learning.
Topic 1.22	**Evaluate opportunities to develop leadership, citizenship, and career skills.**	
	Student Competencies	
	1.22.5	Compare and contrast leadership skills and styles.
	1.22.6	Explain how citizenship activities build skills.
	1.22.7	Demonstrate the importance of career skills in a workplace setting.
	1.22.8	Explain how FFA offices, community service, leadership conferences, career development events, leadership development events, and other opportunities build leadership and citizenship skills.

Standard 3	*ANIMAL SYSTEMS*	
Topic 3.1	**Evaluate the development and implications of animal origin, domestication, and distribution on production practices and the environment.**	
	Student Competencies	
	3.1.3	Examine characteristics of animals that developed in response to environmental and production related influences.
	3.1.4	Analyze the development of a variety of animal industries, technological advancements, research, and engineering practices and how they influenced products, services, and careers.
Topic 3.2	**Assess and select animal production, marketing, and management methods based upon effectiveness and potential social and environmental impacts.**	
	Student Competencies	
	3.2.5	Analyze the impact of animal production, marketing, and management methods on end product quality (e.g., price, sustainability, transportation, labeling, animal welfare, etc.).
	3.2.6	Determine costs of marketing versus predicted increases in sales.
	3.2.7	Execute effective record keeping and documentation practice for animal enterprises.
	3.2.8	Analyze local wildlife populations, challenges, and ecological measures that are being utilized as they relate to animal production.
Topic 3.3	**Analyze laws and sustainable practices that impact animal agriculture from a local, tribal, state, national, and global perspective.**	
	Student Competencies	
	3.3.3	Analyze the roles of state and federal agencies and how they govern animal industries, international trade, and animal production policies.
	3.3.4	Analyze the local and global impact of sustainable animal agriculture practices on human and environmental systems.
Topic 3.4	**Explain management techniques that ensure animal welfare.**	
	Student Competencies	
	3.4.3	Analyze programs that ensure the welfare of animals (e.g., prevent abuse or mistreatment).
	3.4.4	Analyze animal welfare procedures used to ensure safety and minimize stress during management practices.
Topic 3.5	**Analyze procedures to ensure that animal products are safe for consumption.**	
	Student Competencies	
	3.5.4	Utilize technology and equipment to perform animal husbandry and welfare procedures and techniques.
	3.5.5	Analyze consumer concerns with animal production practices relative to human health.
	3.5.6	Analyze the impact of animal traceback capabilities on producers and consumers.
Topic 3.6	**Analyze the nutritional needs of animals.**	
	Student Competencies	
	3.6.2	Differentiate between nutritional needs of animals based on growth stages, anatomy, and/or production systems (e.g., maintenance, gestation, work, growth, etc.).

Topic 3.7	**Analyze feed rations and assess if they meet the nutritional needs of animals.**	
	Student Competencies	
	3.7.3	Evaluate the adequacy of feed rations using data from the analysis of feedstuffs, animal requirements, and performance.
	3.7.4	Compare and contrast methods that utilize feed additives and growth promotants with natural production practices.
Topic 3.8	**Utilize tools, equipment, techniques, and technology to make animal nutrition decisions.**	
	Student Competencies	
	3.8.3	Utilize tools, equipment, techniques, and technology to perform animal nutrition tasks.
	3.8.4	Apply information from a feed label and feeding directions to feed animals.
Topic 3.9	**Evaluate animals for breeding readiness and soundness.**	
	Student Competencies	
	3.9.4	Analyze the functions of major organs in the male and female reproductive systems.
	3.9.5	Describe factors that lead to reproductive maturity.
	3.9.6	Evaluate reproductive disorders that occur in animals.
Topic 3.10	**Apply scientific principles to select and care for breeding animals.**	
	Student Competencies	
	3.10.5	Analyze how genetics can optimize economic, ecological, health, and welfare outcomes.
	3.10.6	Demonstrate how to determine the probability of one or more traits
	3.10.7	Perform a DNA analysis.
	3.10.8	Analyze the care needs for breeding stock in each stage of reproduction.
Topic 3.11	**Apply scientific principles to animal breeding.**	
	Student Competencies	
	3.11.5	Calculate the potential economic benefits of natural versus artificial breeding methods.
	3.11.6	Demonstrate artificial insemination techniques.
	3.11.7	Analyze the processes of major reproductive management practices, including estrous synchronization, superovulation, flushing, and embryo transfer.
	3.11.8	Compare and contrast quantitative breeding value differences between genetically superior animals and animals of average genetic value.
Topic 3.12	**Design and evaluate animal housing, equipment, and handling facilities for the major systems of animal production.**	
	Student Competencies	
	3.12.3	Critique designs for an animal facility and prescribe alternative layouts and adjustments for the safe, sustainable, and efficient use of the facility.
	3.12.4	Analyze the use of modern equipment, technology, and handling facility procedures to determine if they enhance the safe, economic, and sustainable production of animals.
Topic 3.13	**Comply with government regulations and safety standards for facilities used in animal production.**	
	Student Competencies	
	3.13.3	Analyze animal facilities to determine if industry standards have been met.

	3.13.4	Analyze laws pertaining to animal systems.
Topic 3.14	**Classify animals according to taxonomic classification systems and use (e.g., agricultural, companion, etc.).**	
	Student Competencies	
	3.14.4	Classify animals using a taxonomic classification system.
	3.14.5	Analyze the economic value of animals for various applications in the agriculture industry.
	3.14.6	Analyze the visual characteristics of an animal or animal product to select correct classification terminology when referring to companion and production animals.
Topic 3.15	**Apply principles of comparative anatomy and physiology to uses within various animal systems.**	
	Student Competencies	
	3.15.4	Analyze the functions of each animal cell structure.
	3.15.5	Analyze the processes of meiosis and mitosis in animal growth, development, health, and reproduction.
	3.15.6	Compare and contrast animal cells, tissues, organs, body system types, and functions among animal species.
Topic 3.16	**Select animals for specific purposes and maximum performance based on anatomy and physiology.**	
	Student Competencies	
	3.16.3	Compare and contrast desirable anatomical and physiological characteristics of animals within and between species.
	3.16.4	Select products from animals based on industry standards.
Topic 3.17	**Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.**	
	Student Competencies	
	3.17.6	Demonstrate the proper use and function of specific tools, techniques, and technology related to animal health management.
	3.17.7	Perform simple health-check evaluations on animals.
	3.17.8	Analyze illnesses and disorders of animals based on symptoms and problems caused by wounds, diseases, parasites, and physiological disorders.
	3.17.9	Analyze data to evaluate preventive measures for controlling and limiting the spread of diseases, parasites, and disorders among animals.
	3.17.10	Assess the safety and effectiveness of facilities and equipment used for surgical and nonsurgical veterinary treatments and procedures.
Topic 3.18	**Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.**	
	Student Competencies	
	3.18.3	Analyze procedures at the local, state, and national levels to ensure biosecurity of the animal industry.
	3.18.4	Analyze the health risk of different zoonotic diseases to humans and identify prevention methods.
Topic 3.19	**Design management practices related to animal agriculture to enhance the environment.**	
	Student Competencies	
	3.19.2	Assess the effectiveness of methods of reducing the negative effects and maximizing the positive effects of animal agriculture on the environment.

Topic 3.20	Evaluate the effects of environmental conditions on animals.	
	Student Competencies	
	3.20.3	Critique the reliability and validity of evidence presented to support claims regarding the effects of environmental conditions on animal populations and performance (e.g., population changes, emerging species, extinction, climate change, etc.).
	3.20.4	Evaluate the effectiveness of methods to ensure optimal environmental conditions for animals.

Standard 4		***BIOTECHNOLOGY SYSTEMS***
Topic 4.1	**Investigate and explain the relationships in the timeline of developing biotechnology applications and techniques in agriculture (e.g., major innovators, historical developments, potential applications of biotechnology, etc.).**	
	Student Competencies	
	4.1.4	Analyze emerging issues and applications associated with agricultural biotechnology.
	4.1.5	Compare and contrast the benefits and risks associated with using biotechnology to improve agriculture.
	4.1.6	Assess personal skill sets compared to the skills needed for entry level careers in biotechnology.
Topic 4.2	**Evaluate the roles, scope, and implications of regulatory agencies on applications of biotechnology in agriculture and the protection of public interests (e.g., health, safety, environmental issues, etc.).**	
	Student Competencies	
	4.2.4	Compare and contrast biotechnology regulatory systems (e.g., local, state, national, international).
	4.2.5	Analyze the impact regulatory issues have on both the agricultural industry and on public acceptance of biotechnology in agriculture.
	4.2.6	Examine factors and data that regulatory agencies use to evaluate the potential risks a new application of biotechnology may pose to health, safety, and the environment.
Topic 4.3	**Analyze the relationship and implications of bioethics, laws, and public perceptions on applications of biotechnology in agriculture (e.g., ethical, legal, social, cultural issues).**	
	Student Competencies	
	4.3.4	Analyze the implications bioethics may have on future advancements in biotechnology and associated science fields.
	4.3.5	Determine the significance and impacts of legal issues related to biotechnology in agriculture.
	4.3.6	Analyze the impact of public perceptions on the application of biotechnology in different AFNR systems.
Topic 4.4	**Read, document, evaluate, and secure accurate laboratory records of experimental protocols, observations, and results.**	
	Student Competencies	
	4.4.4	Maintain laboratory records documented in a laboratory to ensure data accuracy and integrity (e.g., avoid bias, record any conflicts of interest, avoid misinterpreted results, etc.).
	4.4.5	Determine when security procedures for data and information collected in a laboratory should be implemented.
	4.4.6	Analyze data extracted from a bioinformatics database.
Topic 4.5	**Identify and apply standard laboratory procedures and equipment maintenance to create and maintain reliable data.**	
	Student Competencies	
	4.5.4	Perform ongoing maintenance of laboratory equipment according to the standard operating procedures (e.g., calibration, testing, etc.).
	4.5.5	Operate laboratory equipment and measurement devices to get accurate and repeatable results.
	4.5.6	Perform sterilization techniques for equipment in a laboratory using standard operating procedures.
Topic 4.6	**Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.**	
	Student Competencies	

	4.6.4	Assess the need for personal protective equipment in a variety of situations and select the appropriate equipment to wear when working with biological and chemical materials.
	4.6.5	Demonstrate aseptic techniques in the laboratory.
	4.6.6	Formulate solutions using standard operating procedures (e.g. proper labeling, dilution, etc.).
Topic 4.7	**Safely manage and dispose of biological materials, chemicals, and wastes according to standard operating procedures.**	
	Student Competencies	
	4.7.2	Perform waste disposal according to the standard operating procedures.
Topic 4.8	**Examine and perform scientific procedures using microbes, DNA, RNA and proteins in a laboratory.**	
	Student Competencies	
	4.8.5	Apply appropriate aseptic techniques for isolating different organisms.
	4.8.6	Perform DNA or RNA extraction and purification techniques. (e.g., gel electrophoresis, southern blotting, etc.).
	4.8.7	Demonstrate protein separation techniques and interpret the results.
	4.8.8	Analyze how antibodies are formed and how they can be used in agricultural biotechnology.
Topic 4.9	**Apply biotechnology principles, techniques, and processes to modify a species.**	
	Student Competencies	
	4.9.3	Analyze the processes and techniques used to produce transgenic eukaryotes (e.g., microbial synthetic biology, gene knockout therapy, traditional gene insertion, etc.).
	4.9.4	Transform plant or animal cells by performing a cellular transformation.
Topic 4.10	**Apply biotechnology principles, techniques, and processes to enhance the production of food through the use of microorganisms and enzymes.**	
	Student Competencies	
	4.10.4	Assess the use of biotechnology to detect microbes.
	4.10.5	Analyze processes by which enzymes are produced through biotechnology.
	4.10.6	Compare and contrast the effectiveness, purpose, and outcomes associated with biotechnology as well as conventional processes used in food processing.
Topic 4.11	**Apply biotechnology principles, techniques, and processes to protect the environment and maximize use of natural resources (e.g., biomass, bioprospecting, industrial biotechnology, etc.).**	
	Student Competencies	
	4.11.4	Analyze how biotechnology can be used to monitor the effects of agricultural practices on natural populations.
	4.11.5	Apply the processes used in the production of molecules for use in industrial applications.
	4.11.6	Assess the pros and cons of bioprospecting to achieve a research or product development objective.
Topic 4.12	**Apply biotechnology principles, techniques, and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).**	
	Student Competencies	
	4.12.5	Select techniques and tools used to monitor and direct plant breeding.
	4.12.6	Assess the benefits, risks, and opportunities associated with using biotechnology to promote animal health.
	4.12.7	Distinguish between plant-based and animal-based pharmaceuticals.

	4.12.8	Utilize techniques to measure biodiversity in a population.
Topic 4.13	**Apply biotechnology principles, techniques, and processes to produce bioproducts (e.g., fermentation, transesterification, methanogenesis, etc.).**	
	Student Competencies	
	4.13.6	Analyze the impact of the production and use of bioproducts on the environment.
	4.13.7	Assess the characteristics of biomass that make it useful for bioproduct production.
	4.13.8	Compare the relationship between fermentation and the process used to produce alcohol from biomass.
	4.13.9	Analyze the process used to produce biodiesel from biomass.
	4.13.10	Analyze the process used to produce methane from biomass.
Topic 4.14	**Apply biotechnology principles, techniques, and processes to improve waste management (e.g., genetically modified organisms, bioremediation, etc.).**	
	Student Competencies	
	4.14.5	Analyze the process by which organisms are genetically engineered for waste treatment.
	4.14.6	Assess the processes involved in biotreatment of biological wastes.
	4.14.7	Compare and contrast the processes involved in biotreatment of industrial chemical wastes.
	4.14.8	Analyze the risks and benefits of using biotechnology for bioremediation.

Standard 5	***EDUCATION, COMMUNICATION, AND LEADERSHIP***	
Topic 5.1	**Explore the breadth of opportunities in agricultural education (e.g., using state or national resources, Teach Ag, university program information, professional associations, etc.).**	
	Student Competencies	
	5.1.2	Compare the educational requirements for entry to multiple agricultural education careers.
Topic 5.2	**Apply fundamental understanding of AFNR and agricultural education - including experiential learning - to the development of a workshop or lesson.**	
	Student Competencies	
	5.2.2	Describe the role of an agricultural education program and its contribution to the overall development of students and adults.
Topic 5.3	**Develop and deliver a workshop or lesson using a variety of methods and best practices in instruction and facilitation.**	
	Student Competencies	
	5.3.2	Select methods of instruction that best aligns with the objectives of a workshop, or lesson.
Topic 5.4	**Evaluate facilitation or presentation strategies that encourage appropriate social interactions, embrace diversity, promote equity and build a positive learning environment that is welcoming to all individuals.**	
	Student Competencies	
	5.4.2	Analyze strategies for ensuring an inclusive learning environment that prioritizes diversity, equity, and belonging
Topic 5.5	**Demonstrate impactful leadership as a credible resource for AFNR.**	
	Student Competencies	
	5.5.2	Apply personal leadership traits to enhance professional education and leadership practice in the workplace (e.g., time management, planning, prioritizing, etc.).
Topic 5.6	**Identify the methods and characteristics of effective verbal, nonverbal, written, and visual communication.**	
	Student Competencies	
	5.6.3	Compare and contrast the use of different methods of communication.
	5.6.4	Analyze questions, situations, and criticism within AFNR to determine if they are fact, inference, or opinion.
Topic 5.7	**Analyze the use of verbal, nonverbal, written, and visual communication platforms in AFNR.**	
	Student Competencies	
	5.7.3	Evaluate new ideas or innovations in communications
	5.7.4	Evaluate new ideas or innovations in digital communications (e.g., generative AI, social media, visual communication programs, etc.) used by AFNR professionals and organizations.
Topic 5.8	**Analyze similarities and differences between verbal, nonverbal, written, and visual communication methods.**	
	Student Competencies	
	5.8.4	Examine the use and importance of written communication in AFNR.

	5.8.5	Examine the use and importance of visual communication in AFNR.
	5.8.6	Examine the use and importance of verbal communication in AFNR.
Topic 5.9	**Develop a communications plan that includes purpose, target audience, message, medium, and outcome evaluation.**	
	Student Competencies	
	5.9.2	Examine the primary and secondary target audience(s) for a communications plan.
Topic 5.10	**Identify, apply and demonstrate communication skills and methods per the communications plan.**	
	Student Competencies	
	5.10.4	Use written communication methods to develop a message(s) about AFNR.
	5.10.5	Use visual communication methods to develop a message(s) about AFNR.
	5.10.6	Use verbal communication methods to develop a message(s) about AFNR.
Topic 5.11	**Identify characteristics and behaviors that constitute ethical, efficient, and effective leadership.**	
	Student Competencies	
	5.11.2	Analyze workplace and community leaders and identify what ethical, efficient, and effective leadership characteristics they demonstrate.
Topic 5.12	**Demonstrate leadership through advocacy for AFNR-related issues.**	
	Student Competencies	
	5.12.2	Conduct a self-assessment of personal, ethical, and effective leadership characteristics and reflect upon the results to identify opportunities for improvement.

Standard 6	*ENVIRONMENTAL SYSTEMS*	
Topic 6.1	**Analyze and interpret laboratory and field samples in environmental sustainability systems.**	
	Student Competencies	
	6.1.3	Determine the appropriate sampling techniques needed to generate data.
	6.1.4	Summarize the purpose of statistical analysis methods commonly used in environmental service systems research and explain examples of their use in practice.
Topic 6.2	**Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).**	
	Student Competencies	
	6.2.3	Demonstrate the proper use and maintenance of basic laboratory equipment.
	6.2.4	Demonstrate the proper use and maintenance of environmental monitoring instruments.
Topic 6.3	**Interpret and evaluate the impact of laws, agencies, policies, practices, and consumer preferences affecting environmental service systems.**	
	Student Competencies	
	6.3.5	Analyze how laws associated with environmental sustainability systems are developed for local (e.g., wellhead protection, littering, etc.), tribal, state (e.g., endangered species, etc.), and federal (e.g., Clean Air Clean Water, etc.) governments.
	6.3.6	Analyze the specific purpose of government agencies associated with environmental sustainability systems.
	6.3.7	Analyze the specific purpose of Non Government Organizations associated with environmental sustainability systems.
	6.3.8	Assess the intent, feasibility, and effectiveness of policies, practices, and initiatives common in business and advocacy groups associated with environmental sustainability systems.
Topic 6.4	**Compare and contrast the impact of current trends on regulation of environmental sustainability systems.**	
	Student Competencies	
	6.4.5	Assess the impact of greenhouse gas emissions policies.
	6.4.6	Examine the impact of environmental sustainability systems regulations on international trade.
	6.4.7	Analyze the correlation between increased population size and the need for regulation of environmental sustainability systems.
	6.4.8	Assess the impact of a current policy or topic on the region's environmental sustainability systems.
Topic 6.5	**Examine and summarize the impact of public perceptions and social movements on the regulation of environmental sustainability systems.**	
	Student Competencies	
	6.5.3	Analyze specific changes to perceptions and regulations of environmental sustainability systems and their impact on reducing the ecological, economical, and sociological impact.
	6.5.4	Assess the effectiveness of specific social changes related to regulation of environmental sustainability systems.
Topic 6.6	**Apply meteorology principles to environmental sustainability systems.**	

Student Competencies		
	6.6.5	Examine how components of the atmosphere (e.g., weather systems and patterns, structure of the atmosphere, etc.) affect environmental sustainability systems.
	6.6.6	Compare the relationships between meteorological conditions, air quality, and air pollutants.
	6.6.7	Assess the potential environmental, economic, and social consequences of climate change.
	6.6.8	Analyze how the greenhouse effect may alter the earth's balance of energy.
Topic 6.7	**Apply soil science and hydrology principles to environmental sustainability systems.**	
Student Competencies		
	6.7.7	Determine the land capability classes for a parcel of land using a soil survey.
	6.7.8	Analyze the chemical composition and mineral matter in the soil based on the rock type and parent material.
	6.7.9	Assess the physical qualities of the soil that determine its potential for filtration of groundwater supplies and likelihood for flooding.
	6.7.10	Assess the effectiveness of precautions taken to prevent or reduce contamination of groundwater.
	6.7.11	Analyze how interactions between groundwater and surface water affect flow and availability of water.
	6.7.12	Analyze the importance of the roles played by wetlands in regards to water availability, prevention of flooding, and other factors.
Topic 6.8	**Apply chemistry principles to environmental sustainability systems.**	
Student Competencies		
	6.8.5	Analyze the soil chemistry of a sample.
	6.8.6	Analyze the water chemistry of a sample.
	6.8.7	Analyze how components of atmospheric chemistry (e.g., air chemical components, heat, moisture, etc.) affect air quality.
	6.8.8	Assess how different kinds of wetlands are formed based on the different types of soil and water chemistry present in each case.
Topic 6.9	**Apply microbiology principles to environmental sustainability systems.**	
Student Competencies		
	6.9.5	Examine how the activities of microorganisms in soil affect environmental sustainability systems and ecosystem biodiversity.
	6.9.6	Analyze the microbial populations present in an area and their impact on carbon cycling.
	6.9.7	Examine the impact of wastewater treatment on environmental service systems.
	6.9.8	Conduct bioassay tests related to environmental sustainability systems.
Topic 6.10	**Apply ecology principles to environmental sustainability systems.**	
Student Competencies		
	6.10.5	Calculate the amount of biodiversity in a given area using an appropriate method (e.g., quadrant assessment, transect measurements, etc.).
	6.10.6	Analyze the impact of the current rate of habitat loss on environmental sustainability systems
	6.10.7	Analyze the impact of a population exceeding its carrying capacity on environmental sustainability systems.

	6.10.8	Compare the benefits and drawbacks of using bioindicator species in environmental sustainability systems.
Topic 6.11	**Develop systems of sustainability management for all categories of solid waste in environmental sustainability systems.**	
	Student Competencies	
	6.11.4	Examine how industrial and nonindustrial pollution has damaged the environment.
	6.11.5	Conduct tests to determine the presence and extent of pollution.
	6.11.6	Classify examples of pollution as hazardous or nonhazardous to the local environment.
Topic 6.12	**Sustainably manage solid waste in environmental service systems.**	
	Student Competencies	
	6.12.5	Analyze environmental hazards created by different types of solid waste, solid waste accumulation, and solid waste management.
	6.12.6	Analyze basic sanitary landfill operating procedures and design.
	6.12.7	Apply scientific principles to explain the benefits and processes of composting.
	6.12.8	Analyze different recycling methods.
Topic 6.13	**Apply techniques to ensure a safe supply of drinking water and adequate treatment of wastewater according to applicable rules and regulations.**	
	Student Competencies	
	6.13.3	Analyze all steps in the public drinking water treatment process according to applicable standards.
	6.13.4	Examine the steps necessary to ensure wastewater and septic waste can be safely released into the environment.
Topic 6.14	**Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental sustainability systems.**	
	Student Competencies	
	6.14.6	Compare the advantages and disadvantages of conventional energy sources in regard to environmental sustainability systems.
	6.14.7	Analyze the advantages and disadvantages of alternative energy sources as they pertain to environmental sustainability systems.
	6.14.8	Analyze the main categories of energy consumption.
	6.14.9	Calculate the impact of the carbon cycle imbalance (due to energy consumption).
	6.14.10	Conduct a life cycle assessment for a given source of energy.
Topic 6.15	**Use technological and mathematical tools to map land, facilities, and infrastructure for environmental sustainability systems.**	
	Student Competencies	
	6.15.3	Apply surveying and cartographic skills to make site measurements for a situation involving environmental sustainability systems.
	6.15.4	Apply GIS skills to a situation specific to environmental sustainability systems.
Topic 6.16	**Perform assessments of environmental conditions using equipment, machinery, and technology.**	
	Student Competencies	
	6.16.5	Analyze different measurements of water quality to determine their effectiveness and limitations.

	6.16.6	Compare different measurements of soil quality (e.g., soil horizons, soil texture, organic matter, soil respiration, etc.) to determine their effectiveness and limitations.
	6.16.7	Compare different measurements of air quality (e.g., ozone, carbon monoxide, particulate matter, etc.) to determine their effectiveness and limitations.
	6.16.8	Compare different measurements of assessing ecological health (e.g., quadrat biodiversity assessments, transect surveys, population counts, detection of disease and invasive species, etc.) to determine their effectiveness and limitations.

Standard 7	***FOOD PRODUCTS AND PROCESSING SYSTEMS***	
Topic 7.1	**Distinguish between various food safety programs and management systems in food products and processing facilities.**	
	Student Competencies	
	7.1.3	Compare and contrast the different aspects of safety programs (e.g., Sanitation Standard Operating Procedures (SSOP); Good Manufacturing Practices (GMP); worker safety, etc.).
	7.1.4	Operate equipment used in food products and processing systems (e.g., dehydrator, food processor, mixer, grinder, etc.).
Topic 7.2	**Apply food safety and quality assurance procedures in the harvesting, handling, and processing of food products.**	
	Student Competencies	
	7.2.6	Outline procedures to control possible hazards associated with food products and processing.
	7.2.7	Outline procedures to control possible cross-contamination hazards associated with food products and processing.
	7.2.8	Develop plans that ensure implementation of safe handling procedures on food products.
	7.2.9	Conduct quality assurance tests on food products.
	7.2.10	Execute the procedures of microbiological tests used to detect food-borne pathogens.
Topic 7.3	**Apply food safety procedures during storage and distribution to ensure food quality.**	
	Student Competencies	
	7.3.3	Analyze characteristics of food products and determine appropriate storage procedures.
	7.3.4	Demonstrate methods of documentation procedures within food products and processing systems.
Topic 7.4	**Apply principles of nutrition and biology to develop food products that provide a safe, wholesome, and nutritious food supply for local and global food systems.**	
	Student Competencies	
	7.4.3	Compare and contrast the relative value of food constituents relative to food product qualities (e.g., taste, appearance, etc.).
	7.4.4	Compare and contrast the nutritional needs of different human diets.
Topic 7.5	**Apply principles of microbiology and chemistry to develop food products to provide a safe, wholesome, and nutritious food supply for local and global food systems.**	
	Student Competencies	
	7.5.4	Explain how the chemical and physical properties of foods influence nutritional value and eating quality.
	7.5.5	Analyze the purpose of common food additives and how they influence the chemistry of food.
	7.5.6	Analyze how food products and processing facilities use biochemistry concepts to develop new food products.
Topic 7.6	**Apply principles of human behavior to develop food products to provide a safe, wholesome, and nutritious food supply for local and global food systems.**	
	Student Competencies	
	7.6.3	Analyze the required components on a food label.

	7.6.4	Determine consumer preference and market potential for a new food product using a variety of methods (e.g., double-blind testing, sensory evaluation testing, etc.).
Topic 7.7	**Implement selection, evaluation, and inspection techniques to ensure safe and quality food products.**	
	Student Competencies	
	7.7.5	Analyze factors that affect quality and yield grades of food products.
	7.7.6	Assemble procedures to perform quality-control inspections of raw food products for processing.
	7.7.7	Analyze inspection and harvesting of animals using regulatory agency approved or industry-approved techniques.
	7.7.8	Examine desirable qualities of food products derived from different classifications of food products.
Topic 7.8	**Design and apply techniques of food processing, preservation, packaging, and presentation for distribution and consumption of food products.**	
	Student Competencies	
	7.8.5	Perform conversions between units of measure.
	7.8.6	Prepare foods for sale and distribution for different markets.
	7.8.7	Apply strategies to preserve different foods using various methods and techniques.
	7.8.8	Analyze the degree of desirable food qualities of food stored in various packaging.
Topic 7.9	**Create food distribution plans and procedures to ensure safe delivery of food products.**	
	Student Competencies	
	7.9.4	Compare ways to reduce environmental impact from food distribution activities.
	7.9.5	Examine safety procedures used in food distribution to ensure a safe product is being delivered to consumers.
	7.9.6	Assess how market demand for food products influences the distribution of food products.
Topic 7.10	**Examine the scope of the food industry by evaluating local and global policies, trends, and customs for food production.**	
	Student Competencies	
	7.10.4	Analyze the similarities and differences amongst policies and legislation that affect the food products and processing system in the U.S. or internationally.
	7.10.5	Implement methods to obtain data on food consumer trends in a specific market.
	7.10.6	Analyze food production and distribution outcomes based on cultural customs.
Topic 7.11	**Evaluate the significance and implications of changes and trends in the food products and processing industry in the local and global food systems.**	
	Student Competencies	
	7.11.4	Analyze significant changes and trends in the food products and processing industry.
	7.11.5	Summarize current issues related to the safety and environmental concerns about foods and food processing (e.g., GMOs, irradiation, micro-organisms, contamination, etc.).
	7.11.6	Analyze desirable and undesirable outcomes of emerging technologies used in the food products and processing systems.
Topic 7.12	**Identify the purpose of industry organizations, groups, and regulatory agencies that influence the local and global food systems.**	
	Student Competencies	

	7.12.3	Analyze the changes in the food products and processing industry brought about by industry organizations or regulatory agencies.
	7.12.4	Assess the application of industry standards in the food products and processing industry.
Topic 7.13	**Evaluate the effectiveness of current sustainability practices in their role to food products and processing**	
	Student Competencies	
	7.13.3	Summarize why sustainability plays a key role in the food industry.
	7.13.4	Analyze the performance and efficiency of various practices for sustainable food production, distribution, and waste.

Standard 8	*NATURAL RESOURCES SYSTEMS*	
Topic 8.1	**Examine natural resource availability and ecosystem function in a particular region.**	
	Student Competencies	
	8.1.4	Use dichotomous key to classify organisms.
	8.1.5	Analyze the interdependence of organisms within an ecosystem (e.g., food webs, niches, impact of keystone species, etc.).
	8.1.6	Analyze how species evolve, are naturally selected, and adapt.
Topic 8.2	**Classify different types of natural resources in order to enable protection, conservation, enhancement, and management in a particular geographical region.**	
	Student Competencies	
	8.2.7	Apply identification techniques to determine the species of a tree or woody plant.
	8.2.8	Apply identification techniques to determine the species of an herbaceous plant.
	8.2.9	Apply identification techniques to determine the species of wildlife or insect.
	8.2.10	Apply identification techniques to determine the species of an aquatic organism.
	8.2.11	Apply identification techniques to determine the types of abiotic resources in an area.
	8.2.12	Apply procedures for conducting resource inventories and population studies.
Topic 8.3	**Apply ecological concepts and principles (e.g., weather, air quality, UV protection, atmospheric pressure, etc.) to the interaction of atmospheric and natural resource systems.**	
	Student Competencies	
	8.3.3	Assess the role that the atmosphere plays in the regulation of biogeochemical cycles.
	8.3.4	Analyze the impact that climate has on natural resources and how this impact has changed due to human activity.
Topic 8.4	**Apply ecological concepts and principles to aquatic natural resource systems.**	
	Student Competencies	
	8.4.5	Assess the function of watersheds and their effect on natural resources.
	8.4.6	Analyze how different classifications of ground and surface water affect ecosystem function.
	8.4.7	Compare and contrast techniques used in the creation, enhancement, and management of riparian zones and riparian buffers.
	8.4.8	Model techniques used in the creation, enhancement, and management of structures used to control or reduce stream bank erosion.
Topic 8.5	**Apply ecological concepts and principles to terrestrial natural resource systems.**	
	Student Competencies	
	8.5.5	Analyze examples of stages of succession.
	8.5.6	Analyze examples of habitat disturbances and habitat resilience.
	8.5.7	Analyze a forest in order to determine which forestry techniques would improve that habitat.
	8.5.8	Analyze a plot of land in order to determine which soil management techniques would be most applicable.
Topic 8.6	**Apply ecological concepts and principles to biotic organisms in natural resource systems.**	

Student Competencies		
	8.6.3	Analyze the factors that influence population density and population dispersion in natural resource systems.
	8.6.4	Analyze factors that influence the establishment and spread of invasive species.
Topic 8.7	**Examine and interpret the purpose, enforcement, impact, and effectiveness of laws, agencies, and private and public organizations related to natural resource management, protection, enhancement, and improvement (e.g., water regulations, game laws, environmental policy, local, state, and national conservation organizations, agricultural extension service, etc.).**	
Student Competencies		
	8.7.3	Analyze laws associated with natural resources systems.
	8.7.4	Analyze the relationships between public and private agencies and organizations associated with natural resources systems.
Topic 8.8	**Assess the impact of human activities on the availability of natural resources.**	
Student Competencies		
	8.8.4	Assess how different kinds of human activity (e.g., agriculture, infrastructure development, transportation, etc.) affect the use and availability of natural resources.
	8.8.5	Assess causes of extinction and how those causes related to loss of biodiversity.
	8.8.6	Analyze possible solutions to reduce the depletion of natural resources.
Topic 8.9	**Analyze how social perceptions of natural resource management, protection, enhancement, and improvement change and develop over time.**	
Student Competencies		
	8.9.4	Analyze how social perceptions can affect the use and sustainability of natural resources.
	8.9.5	Examine the relationship between current trends in natural resource systems and historical figures and movements that played a prominent role in shaping how natural resources are viewed and used today.
	8.9.6	Analyze how some technological advancements changed how natural resources were used and viewed (e.g., Industrial Revolution, fossil fuels, green technology, etc.).
Topic 8.10	**Examine and explain how economics affects the use of natural resources.**	
Student Competencies		
	8.10.4	Assess whether economic value increases or decreases the conservation, protection, improvement, and enhancement of natural resources.
	8.10.5	Assess the importance of the use of natural resources on local, tribal, state, and national economies.
	8.10.6	Analyze how the adoption of green technology and/or alternative energy affected a local, tribal, state, or national economy.
Topic 8.11	**Communicate information to the public regarding topics related to the management, protection, enhancement, and improvement of natural resources.**	
Student Competencies		
	8.11.4	Assess the effectiveness of different methods for communicating natural resource messages.
	8.11.5	Assess how to most effectively communicate a message about the conservation, management, enhancement, and improvement of natural resources via social media and the Internet.

	8.11.6	Analyze examples of how communication can be used to influence behavior, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources.
Topic 8.12	**Sustainably produce, harvest, process, and use natural resource products (e.g., forest and rangeland products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).**	
	Student Competencies	
	8.12.9	Assess harvesting methods in regards to their economic value, environmental impact, and other factors.
	8.12.10	Assess techniques used to harvest wildlife in regards to sustainability, practicality, and other factors.
	8.12.11	Assess the economic impact of mineral extraction in regards to the costs and benefits to a local, tribal, state, and/or national economy.
	8.12.12	Assess the economic impact of fossil fuel extraction in regards to the costs and benefits to a local, tribal, state, and/or national economy.
	8.12.13	Assess the economic impact of shale oil extraction (i.e., fracking) in regards to the costs and benefits to a local, tribal, state, and/or national economy.
	8.12.14	Assess factors that affect the economic, environmental, and social sustainability in regards to the use of alternative sources of energy.
	8.12.15	Assess different options for improving the sustainability of outdoor recreation based on its impact on natural resources and likelihood of acceptance.
	8.12.16	Analyze techniques used to acquire aquatic species for their environmental, economic, and social sustainability.
Topic 8.13	**Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing and evaluating natural resource management plans.**	
	Student Competencies	
	8.13.3	Apply cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources.
	8.13.4	Analyze an area's resources using GIS technologies.
Topic 8.14	**Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques.**	
	Student Competencies	
	8.14.7	Assess indicators of the biological health of a stream.
	8.14.8	Assess the methods used to improve a forest stand.
	8.14.9	Assess methods of wildlife habitat management.
	8.14.10	Apply methods for rangeland management for multiple ecosystem services.
	8.14.11	Assess management techniques for improving outdoor recreation opportunities.
	8.14.12	Assess methods to improve marine and coastal natural resources.
Topic 8.15	**Diagnose plant and wildlife diseases and follow protocols to prevent their spread.**	
	Student Competencies	
	8.15.3	Analyze a plant disease based on its symptoms.
	8.15.4	Analyze a wildlife or aquatic species disease based on its symptoms.

Topic 8.16	**Prevent or manage introduction of ecologically harmful species in a particular region.**	
	Student Competencies	
	8.16.3	Analyze signs of the spread of ecologically harmful species.
	8.16.4	Implement a plan for preventing the spread of ecologically harmful species for its effectiveness.
Topic 8.17	**Manage fires in natural resource systems.**	
	Student Competencies	
	8.17.3	Assess techniques used to fight wildfires, manage prescribed fires and ensure human safety.
	8.17.4	Assess the effectiveness of techniques previously and currently used to prevent harmful fires.

Standard 9	***PLANT SYSTEMS***	
Topic 9.1	**Determine the influence of environmental factors on plant growth.**	
	Student Competencies	
	9.1.4	Analyze plant responses to light color, intensity, and duration.
	9.1.5	Determine the optimal environmental conditions for plant growth.
	9.1.6	Analyze plant responses to water quality and quantity.
Topic 9.2	**Prepare and adjust growing media for use in plant systems.**	
	Student Competencies	
	9.2.3	Describe the physical and chemical characteristics of growing media and explain the influence they have on plant growth.
	9.2.4	Discuss how differences in growing media can affect drainage (e.g., drain tile, surface drainage, tillage, porosity, irrigation, etc.).
Topic 9.3	**Demonstrate planting techniques and create the conditions needed for seed germination.**	
	Student Competencies	
	9.3.2	Plant a crop using the appropriate steps.
Topic 9.4	**Develop and implement a nutrient management and/or fertilizer plan for specific plants or crops.**	
	Student Competencies	
	9.4.6	Identify nutrient deficiencies in plants.
	9.4.7	Contrast pH and cation exchange capacity between mineral soil and soilless growing media.
	9.4.8	Interpret laboratory analyses of soil and tissue samples
	9.4.9	Calculate the amount of fertilizer to be applied based on nutrient recommendation and fertilizer analysis.
	9.4.10	Assess the short-and long-term effects of production methods focused on sustainable soil management.
Topic 9.5	**Classify plants according to taxonomic systems.**	
	Student Competencies	
	9.5.2	Classify the morphological characteristics and systems used to identify agricultural and herbaceous plants (e.g., life cycles, growth habit, plant use and as monocotyledons, or dicotyledons, woody, herbaceous, etc.) by common and scientific names.
Topic 9.6	**Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.**	
	Student Competencies	
	9.6.7	Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems.
	9.6.8	Analyze root tissues and explain the pathway of water and nutrients into and through root tissues.
	9.6.9	Contrast the difference in arrangement of vascular tissue between monocot and dicot plant stems.
	9.6.10	Analyze how leaves capture light energy and exchange gasses.
	9.6.11	Differentiate between the types of flowers and flower inflorescence (e.g., complete, incomplete, perfect, imperfect).
	9.6.12	Categorize the major types of seeds and fruits.

Topic 9.7	**Apply knowledge of plant physiology and energy conversion to plant systems.**	
	Student Competencies	
	9.7.6	Differentiate between the types of photosynthesis (e.g., c3, c4, Cam) and its stages (e.g., light dependent and light independent reactions).
	9.7.7	Analyze factors that affect the rate of cellular respiration in a given crop production setting.
	9.7.8	Analyze plant growth and the process of secondary plant growth.
	9.7.9	Analyze the plant responses to plant growth regulators and different forms of tropism.
	9.7.10	Analyze the factors affecting the rate and products of transpiration, translocation, and assimilation.
Topic 9.8	**Demonstrate plant propagation techniques in plant system activities.**	
	Student Competencies	
	9.8.6	Apply the process of plant pollination and/or fertilization.
	9.8.7	Examine factors that affect seed viability, vigor, and germination rates.
	9.8.8	Demonstrate plant propagation techniques (e.g., cuttings, division, separation, layering, budding and grafting, etc.).
	9.8.9	Examine aseptic micropropagation techniques.
	9.8.10	Compare and contrast the potential risks and advantages associated with genetically modified agricultural and ornamental plants.
Topic 9.9	**Develop and implement a management plan for plant production.**	
	Student Competencies	
	9.9.8	Inspect propagation material for evidence of pests or disease.
	9.9.9	Prepare soil and growing media for planting with the addition of amendments.
	9.9.10	Assess how pre-plant treatments are used on seeds and plants.
	9.9.11	Adjust environmental conditions based on the progress of plantings.
	9.9.12	Demonstrate proper techniques to control and manage plant growth through mechanical, cultural, or chemical means.
	9.9.13	Compare and contrast the types of technologies used for controlled atmosphere production.
	9.9.14	Compare and contrast the types of systems used in hydroponic and aquaponic plant production.
Topic 9.10	**Develop and implement a plan for integrated pest management for plant production.**	
	Student Competencies	
	9.10.5	Categorize common local weeds, insect pests, fungal, viral, bacterial, and infectious and noninfectious plant diseases.
	9.10.6	Predict pest and disease problems based on environmental conditions and life cycles.
	9.10.7	Calculate pesticide formulations including organic and synthetic active ingredients and selection of pesticides to control specific pests.
	9.10.8	Apply procedures for the safe handling, use, and storage of pesticides including personal protective equipment and Restricted Entry Interval.
Topic 9.11	**Apply principles and practices of sustainable agriculture to plant production.**	
	Student Competencies	

	9.11.4	Analyze the alignment of modern technologies used in production systems (e.g., precision agriculture, GE crops, etc.) with USDA sustainable practices criteria.
	9.11.5	Examine the environmental impacts (e.g., carbon footprint, greenhouse gas, sustainability, food security, etc.) of the national/international production system on local/regional production system markets.
	9.11.6	Examine differing research conclusions related to environmental factors and their effect on plant production.
Topic 9.12	**Harvest crops according to industry standards.**	
	Student Competencies	
	9.12.3	Assess the stage of growth to determine crop maturity or marketability.
	9.12.4	Analyze crop yield and loss data.
Topic 9.13	**Haul and store crops according to industry standards.**	
	Student Competencies	
	9.13.4	Analyze practices used to maintain a safe product through harvest, processing, storage, and shipment (e.g., Food Safety Modernization Act, Good Agricultural Practices, etc.).
	9.13.5	Analyze the proper conditions required to maintain the quality of plants and plant products held in storage and during shipping.
	9.13.6	Demonstrate techniques for grading, handling, and packaging plants and plant products for distribution.

Standard 10	***POWER, STRUCTURAL, AND TECHNICAL SYSTEMS***	
Topic 10.2	**Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.**	
	Student Competencies	
	10.2.4	Perform mathematical calculations to determine the mechanical advantage of simple machines in AFNR related mechanical systems.
	10.2.5	Calculate the maintenance and purchase cost of tools, machines, and equipment used in AFNR.
	10.2.6	Demonstrate the proper selection, maintenance, and use of tools (including measuring tape), machines, and equipment.
Topic 10.4	**Perform preventative maintenance and scheduled service to maintain equipment, machinery, and power units used in AFNR settings.**	
	Student Competencies	
	10.4.3	Perform preventative maintenance for equipment, machinery, and power units used in AFNR power, structural and technical systems.
	10.4.4	Perform service procedures for mechanical systems on equipment, machinery, and power units in accordance with manufacturer's manuals.
Topic 10.5	**Operate machinery and equipment while observing all safety precautions in AFNR settings.**	
	Student Competencies	
	10.5.3	Perform pre-operation inspections, start-up, and shut-down procedures on equipment, machinery and power units as specified in manufacturer's manuals.
	10.5.4	Operate equipment, machinery, and power units using safety principles and practices.
Topic 10.7	**Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.**	
	Student Competencies	
	10.7.4	Perform the measurements of the basic units of electrical circuits (e.g., motors, controls, lighting, etc.) with the appropriate tools.
	10.7.5	Utilize electrical systems, symbols, and diagrams.
	10.7.6	Select materials and tools used in electrical control circuit installation.
Topic 10.14	**Apply current and/or identify emerging technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.**	
	Student Competencies	
	10.14.3	Analyze data using current and emerging technologies.
	10.14.4	Examine the change in output after using technologies in AFNR systems.

Topic 10.15	**Prepare and/or use electrical drawings to design, install, and troubleshoot electronic control systems in AFNR settings.**	
	Student Competencies	
	10.15.4	Analyze schematic drawings for electrical control systems.
	10.15.5	Select the correct electrical sensor for a given application.
	10.15.6	Assess the functions of programmable logic controllers (PLC), microcontrollers, and other computer-based systems.
Topic 10.16	**Apply geospatial principles and technologies to solve problems and increase the efficiency of AFNR systems.**	
	Student Competencies	
	10.16.3	Assess geospatial technology (i.e., GPS, GIS, remote sensing, telematics, etc.) use and applications in AFNR systems.
	10.16.4	Analyze the economic impact of utilizing precision technologies (e.g., GPS/GIS, remote sensing, etc.) in AFNR systems.