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.

Grade 9-12

½ or 1 credit

Max Credit = 1

Standard 1	AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) CLUSTER SKILLS		
Topic 1.1	***Analyze how issues, trends, technologies, and public policies impact systems in the Agriculture, Food, & Natural Resources Career Cluster.***		
	Student Competencies		
	1.1.1	**RESEARCH, EXAMINE, AND DISCUSS ISSUES AND TRENDS THAT IMPACT AFNR SYSTEMS ON LOCAL, STATE, NATIONAL, AND GLOBAL LEVELS.**	
		1.1.1.3	Analyze and summarize AFNR issues and their impact on local, state, national, and global levels.
		1.1.1.4	Analyze current trends in AFNR systems and predict their impact on local, state, national, and global levels.
	1.1.2	**EXAMINE TECHNOLOGIES AND ANALYZE THEIR IMPACT ON AFNR SYSTEMS.**	
		1.1.2.3	Apply appropriate use of technologies in AFNR workplace scenarios.
		1.1.2.4	Analyze how technology is used in AFNR systems to maximize productivity.
	1.1.3	**IDENTIFY PUBLIC POLICIES AND EXAMINE THEIR IMPACT ON AFNR SYSTEMS.**	
		1.1.3.3	Analyze and assess at least two public policies that impact each AFNR system.
		1.1.3.4	Create and propose a hypothetical policy that will impact current AFNR systems.
Topic 1.2	***Evaluate the nature and scope of the Agriculture, Food, & Natural Resources Career Cluster and the role of agriculture, food, and natural resources (AFNR) in society and the economy.***		
	Student Competencies		
	1.2.1	**RESEARCH AND USE GEOGRAPHIC AND ECONOMIC DATA TO SOLVE PROBLEMS IN AFNR SYSTEMS.**	
		1.2.1.1	Research and describe different types of geographic data used in AFNR systems.
		1.2.1.2	Identify and examine economic data related to AFNR systems (e.g., commodity markets, food marketing, food, and nutritional assistance programs, etc.).
	1.2.2	**EXAMINE THE COMPONENTS OF THE AFNR SYSTEMS AND ASSESS THEIR IMPACT ON THE LOCAL, STATE, NATIONAL, AND GLOBAL SOCIETY AND ECONOMY.**	
		1.2.2.1	Identify and summarize the components within AFNR systems (e.g., Animal Systems: health, nutrition, genetics, etc.; Natural Resources Systems: soil, water, etc.).
		1.2.2.2	Define and summarize societies on local, state, national, and global levels and describe how they relate to AFNR systems.
		1.2.2.3	Examine and summarize the components of the agricultural economy (e.g., environmental, crops, livestock, etc.).

Topic 1.3	***Examine and summarize the importance of health, safety, and environmental management systems in AFNR workplaces.***		
	Student Competencies		
	1.3.1	**IDENTIFY AND EXPLAIN THE IMPLICATIONS OF REQUIRED REGULATIONS TO MAINTAIN AND IMPROVE SAFETY, HEALTH, AND ENVIRONMENTAL MANAGEMENT SYSTEMS.**	
		1.3.1.1	Research and explain the implications of regulatory, safety, and health standards on AFNR systems (e.g., SDS, bioterrorism, etc.)
		1.3.1.2	Summarize the importance of safety, health, and environmental management in the workplace.
		1.3.1.3	Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
	1.3.2	**DEVELOP AND IMPLEMENT A PLAN TO MAINTAIN AND IMPROVE HEALTH, SAFETY, AND ENVIRONMENTAL COMPLIANCE AND PERFORMANCE.**	
		1.3.2.1	Research and identify components required in health and safety performance plans.
		1.3.2.2	Examine and categorize examples of environmental compliance plans from AFNR workplace.
		1.3.2.3	Analyze the effectiveness of health and safety performance plans of an AFNR workplace.
	1.3.3	**APPLY HEALTH AND SAFETY PRACTICES TO AFNR WORKPLACES.**	
		1.3.3.1	Research and summarize the purposes and objectives of health and safety policies and procedures relevant to AFNR careers.
		1.3.3.2	Identify emergency response procedures for health and safety issues at AFNR workplaces.
		1.3.3.3	Examine and categorize examples of how to avoid health or safety risks in AFNR workplaces.
		1.3.3.4	Examine and categorize the risk level of contamination or injury as associated with AFNR tasks in the workplace.
	1.3.4	**USE APPROPRIATE PROTECTIVE EQUIPMENT AND DEMONSTRATE SAFE AND PROPER USE OF AFNR TOOLS AND EQUIPMENT.**	
		1.3.4.1	Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.).
		1.3.4.2	Identify standard tools, equipment and safety procedures related to AFNR tasks.
		1.3.4.3	Read and interpret operating instructions related to operation, storage and maintenance of tools and equipment related AFNR tasks.
		1.3.4.4	Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.

Topic 1.5	***Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food, & Natural Resources career pathways.***		
	Student Competencies		
	1.5.1	**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.).**	
		1.5.1.3	Research and summarize specific tools (e.g., resumes, portfolios, cover letters, etc.) and processes (e.g., interviews, applications, etc.) needed to pursue a career in an AFNR pathway.
		1.5.1.4	Create a personal plan outlining goals and steps to obtain a career in an AFNR pathway.
		1.5.1.5	Analyze personal skillset and create a plan for obtaining the required education, training, and experiences to obtain a career in an AFNR pathway.
	1.5.2	**EXAMINE AND CHOOSE CAREER OPPORTUNITIES THAT ARE MATCHED TO PERSONAL SKILLS, TALENTS, AND CAREER GOALS IN AN AFNR PATHWAY OF INTEREST.**	
		1.5.2.3	Assess personal skills and align them with potential career opportunities in AFNR pathways.
		1.5.2.4	Assemble and analyze examples of careers and related statistics on a local, state, national, and global level.
Topic 1.6	***Analyze the interaction among AFNR systems in the production, processing, and management of food, fiber, and fuel and the sustainable use of natural resources.***		
	Student Competencies		
	1.6.1	**EXAMINE AND EXPLAIN FOUNDATIONAL CYCLES AND SYSTEMS OF AFNR.**	
		1.6.1.3	Analyze and explain how foundational cycles affect production, processing, and management of food, fiber, and fuel.
		1.6.1.4	Analyze AFNR systems and determine their impact on producing and processing food, fiber, and fuel.
	1.6.2	**ANALYZE AND EXPLAIN THE CONNECTION AND RELATIONSHIPS BETWEEN DIFFERENT AFNR SYSTEMS ON A NATIONAL AND GLOBAL LEVEL.**	
		1.6.2.3	Analyze differences between AFNR systems on a national and global scale.
		1.6.2.4	Analyze the connections and relationships impacted when there is a change in an AFNR system on a national and global level.

Standard 3	ANIMAL SYSTEMS		
Topic 3.1	***Analyze historic and current trends impacting the animal systems industry.***		
	Student Competencies		
	3.1.1	**EVALUATE THE DEVELOPMENT AND IMPLICATIONS OF ANIMAL ORIGIN, DOMESTICATION, AND DISTRIBUTION ON PRODUCTION PRACTICES AND THE ENVIRONMENT.**	
		3.1.1.3	Evaluate and describe characteristics of animals that developed in response to the animal's environment and led to their domestication.
		3.1.1.4	Describe the historical and scientific developments of different animal industries and summarize the products, services, and careers associated with each.
		3.1.1.5	Evaluate the implications of animal adaptations on production practices and the environment.
		3.1.1.6	Predict trends and implications of future developments within different animal industries on production practices and the environment.
	3.1.2	**ASSESS AND SELECT ANIMAL PRODUCTION METHODS FOR USE IN ANIMAL SYSTEMS BASED UPON THEIR EFFECTIVENESS AND IMPACTS.**	
		3.1.2.5	Analyze the impact of animal production methods on end product qualities (e.g., price, sustainability, marketing, labeling, animal welfare, etc.).
		3.1.2.6	Calculate costs of marketing versus predicted increases in sales.
		3.1.2.7	Analyze and evaluate the accuracy and effectiveness of records used in an animal system business.
		3.1.2.8	Research and summarize local wildlife populations, challenges and ecological measures that are being utilized.
	3.1.3	**ANALYZE AND APPLY LAWS AND SUSTAINABLE PRACTICES TO ANIMAL AGRICULTURE FROM A GLOBAL PERSPECTIVE.**	
		3.1.3.1	Distinguish between the types of laws pertaining to animal systems.
		3.1.3.2	Research and summarize sustainability in animal systems.
Topic 3.3	***Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction, and/or economic production.***		
	Student Competencies		
	3.3.1	**ANALYZE THE NUTRITIONAL NEEDS OF ANIMALS.**	
		3.3.1.1	Identify and summarize essential nutrients required for animal health and analyze each nutrient's role in growth and performance.
		3.3.1.2	Differentiate between nutritional needs of animal species.
		3.3.1.3	Differentiate between nutritional needs of animals in different growth stages and production systems (e.g., maintenance, gestation, natural, organic, etc.).
		3.3.1.4	Correlate a species' nutritional needs to feedstuffs that could meet those needs.

	3.3.2	**ANALYZE FEED RATIONS AND ASSESS IF THEY MEET THE NUTRITIONAL NEEDS OF ANIMALS.**	
		3.3.2.1	Compare and contrast common types of feedstuffs and the roles they play in the diets of animals.
		3.3.2.2	Examine the importance of a balanced ration for animals based on the animal's growth stage (e.g., maintenance, newborn, gestation, lactation, etc.).
		3.3.2.3	Examine the purpose, impact and mode of action of feed additives and growth promotants in animal production.
		3.3.2.4	Determine the relative nutritional value of feedstuffs by evaluating their general quality and condition.
	3.3.3	**UTILIZE INDUSTRY TOOLS TO MAKE ANIMAL NUTRITION DECISIONS.**	
		3.3.3.1	Identify and categorize tools and equipment used to meet animal nutrition needs and ensure an abundant and safe food supply.
		3.3.3.2	Examine and summarize the meaning of various components of feed labels and feeding directions.
		3.3.3.3	Examine the use of technology to provide animal nutrition.
		3.3.3.4	Utilize tools and equipment to perform animal nutrition tasks.
Topic 3.4	***Apply principles of animal reproduction to achieve desired outcomes for performance, development, and/or economic production.***		
	Student Competencies		
	3.4.1	**EVALUATE ANIMALS FOR BREEDING READINESS AND SOUNDNESS.**	
		3.4.1.1	Identify and categorize the male and female reproductive organs of the major animal species.
		3.4.1.2	Compare and contrast how age, size, life cycle, maturity level, and health status affect the reproductive efficiency of male and female animals.
		3.4.1.3	Summarize the importance of efficient and economic reproduction in animals.
	3.4.2	**APPLY SCIENTIFIC PRINCIPLES TO SELECT AND CARE FOR BREEDING ANIMALS.**	
		3.4.2.1	Summarize genetic inheritance in animals.
		3.4.2.2	Identify and summarize inheritance and terms related to inheritance in animal breeding (e.g., dominate, co-dominate, recessive, homozygous, heterozygous, etc.).
		3.4.2.3	Identify and summarize genetic defects that affect animal performance.
		3.4.2.4	Identify and summarize different needs of breeding animals based on their growth stages (e.g., newborn, parturition, gestation, gestation lengths, etc.).
	3.4.3	**APPLY SCIENTIFIC PRINCIPLES TO BREED ANIMALS.**	
		3.4.3.1	Identify and categorize natural and artificial breeding methods (e.g., natural breeding, artificial insemination, estrous synchronization, flushing, cloning, etc.).
		3.4.3.2	Analyze the materials, methods and processes of artificial insemination.
		3.4.3.3	Identify and summarize the advantages and disadvantages of major reproductive management practices, including estrous synchronization, superovulation, flushing, and embryo transfer (e.g., cost, labor, equipment, etc.).

		3.4.3.4	Examine the use of quantitative breeding values (e.g., EPDs, Performance records, pedigrees) in the selection of genetically superior breeding stock.
Topic 3.6	***Classify, evaluate, and select animals based on anatomical and physiological characteristics.***		
	Student Competencies		
	3.6.2	**APPLY PRINCIPLES OF COMPARATIVE ANATOMY AND PHYSIOLOGY TO USES WITHIN VARIOUS ANIMAL SYSTEMS.**	
		3.6.2.1	Research and summarize characteristics of a typical animal cell and identify the organelles.
		3.6.2.2	Examine the basic functions of animal cells in animal growth and reproduction.
		3.6.2.3	Identify and summarize the properties, locations, functions, and types of animal cells, tissues, organs, and body systems.
		3.6.2.4	Analyze the functions of each animal cell structure.
Topic 3.7	***Apply principles of effective animal health care.***		
	Student Competencies		
	3.7.1	**DESIGN PROGRAMS TO PREVENT ANIMAL DISEASES, PARASITES, AND OTHER DISORDERS AND ENSURE ANIMAL WELFARE.**	
		3.7.1.1	Identify and summarize specific tools and technology used in animal health management.
		3.7.1.2	Explain methods of determining animal health and disorders.
		3.7.1.3	List and summarize the characteristics of wounds, common diseases, parasites, and physiological disorders that affect animals.
		3.7.1.4	Identify and summarize characteristics of causal agents and vectors of diseases and disorders in animals.
	3.7.2	**ANALYZE BIOSECURITY MEASURES UTILIZED TO PROTECT THE WELFARE OF ANIMALS ON A LOCAL, STATE, NATIONAL, AND GLOBAL LEVEL.**	
		3.7.2.1	Summarize the importance of biosecurity to the animal industry at multiple levels (e.g., local, state, national, global).
		3.7.2.2	Identify and describe zoonotic diseases including their historical significance and potential future implications.
		3.7.2.3	Analyze procedures at the local, state, and national levels to ensure biosecurity of the animal industry.

Standard 4	BIOTECHNOLOGY SYSTEMS		
Topic 4.1	***Assess factors that have influenced the evolution of biotechnology in agriculture (e.g., historical events, societal trends, ethical, and legal implications, etc.).***		
	Student Competencies		
	4.1.1	**INVESTIGATE AND EXPLAIN THE RELATIONSHIP BETWEEN PAST, CURRENT AND EMERGING APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE (E.G., MAJOR INNOVATORS, HISTORICAL DEVELOPMENTS, POTENTIAL APPLICATIONS OF BIOTECHNOLOGY, ETC.).**	
		4.1.1.1	Research and summarize the evolution of biotechnology in agriculture.
		4.1.1.2	Examine and categorize current applications and gains achieved in applying biotechnology to agriculture.
		4.1.1.3	Distinguish between current and emerging applications of biotechnology in agriculture.
		4.1.1.4	Compare and contrast the benefits and risks of biotechnology compared with alternative approaches to improving agriculture.
		4.1.1.5	Analyze the developmental progression of biotechnology and the evolution of scientific knowledge.
		4.1.1.6	Assess and summarize current work in biotechnology being done to add value to agricultural and society.
		4.1.1.7	Analyze and document emerging problems and issues associated with agricultural biotechnology.
		4.1.1.8	Assess the benefits and risks associated with using biotechnology to improve agriculture.
	4.1.2	**EVALUATE THE SCOPE AND IMPLICATIONS OF REGULATORY AGENCIES ON APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE AND PROTECTION OF PUBLIC INTERESTS (E.G., HEALTH, SAFETY, ENVIRONMENTAL ISSUES, ETC.).**	
		4.1.2.1	Compare and contrast differences between regulatory systems worldwide.
		4.1.2.2	Research and document major regulatory issues related to biotechnology in agriculture.
		4.1.2.3	Explain the relationship between regulatory agencies and the protection of public interests such as health, safety, and the environment.
	4.1.3	**ANALYZE THE RELATIONSHIP AND IMPLICATIONS OF BIOETHICS, LAWS, AND PUBLIC PERCEPTIONS ON APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE (E.G., ETHICAL, LEGAL, SOCIAL, CULTURAL ISSUES).**	
		4.1.3.1	Research and summarize the emergence, evolution, and implications of bioethics associated with biotechnology in agriculture.
		4.1.3.2	Research and summarize legal issues related to biotechnology in agriculture (e.g., protection of intellectual property through patents, copyright, trademarks, etc.).
		4.1.3.3	Research and summarize public perceptions of biotechnology in agriculture (e.g., social and cultural issues).
		4.1.3.4	Analyze the implications bioethics may have on future advancements in AFNR.
		4.1.3.5	Determine the significance and impacts of legal issues related to biotechnology in agriculture.

		4.1.3.6	Analyze the impact of public perceptions on the application of biotechnology in different AFNR systems.
Topic 4.2	***Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).***		
	Student Competencies		
	4.2.1	**READ, DOCUMENT, EVALUATE, AND SECURE ACCURATE LABORATORY RECORDS OF EXPERIMENTAL PROTOCOLS, OBSERVATIONS, AND RESULTS.**	
		4.2.1.1	Compare and contrast common record-keeping methods used in a laboratory (e.g., paper notebook, electronic notebook, etc.).
		4.2.1.2	Research and summarize the need for data and information security in a laboratory and demonstrate best practices.
		4.2.1.3	Evaluate the role of bioinformatics in agriculture and summarize the types of databases that are available (e.g., genomic, transcriptomics, etc.).
		4.2.1.4	Maintain and interpret 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.).
	4.2.2	**IMPLEMENT STANDARD OPERATING PROCEDURES FOR THE PROPER MAINTENANCE, USE, AND STERILIZATION OF EQUIPMENT IN A LABORATORY.**	
		4.2.2.1	Identify, interpret, and implement standard operating procedures for laboratory equipment.
		4.2.2.2	Categorize and identify laboratory equipment according to its purpose in scientific research.
		4.2.2.3	Differentiate between sterilization techniques for equipment in a laboratory (e.g., media bottles vs. laminar flow hood, etc.).
		4.2.2.4	Develop a maintenance program for laboratory equipment based upon the standard operating procedures.
		4.2.2.5	Manipulate basic laboratory equipment and measurement devices (e.g., water bath, electrophoresis equipment, micropipettes, laminar flow hood, etc.).
		4.2.2.6	Create a plan for sterilizing equipment in a laboratory according to standard operating procedures.
	4.2.3	**APPLY STANDARD OPERATING PROCEDURES FOR THE SAFE HANDLING OF BIOLOGICAL AND CHEMICAL MATERIALS IN A LABORATORY.**	
		4.2.3.1	Classify and document basic aseptic techniques in the laboratory.
		4.2.3.2	Examine and implement standard operating procedures for the use of biological materials according to directions and their classification (e.g., proper handling of bacteria or DNA before, during and after use).

	4.2.3.3	Categorize and label the types of solutions that are commonly prepared in a laboratory (e.g., buffers, reagents, media, etc.).
	4.2.3.4	Demonstrate advanced aseptic techniques in the laboratory (e.g., sterile work area, sterile handling, personal hygiene, etc.).
	4.2.3.5	Analyze and select an appropriate standard operating procedure for working with biological materials based upon their classification.
	4.2.3.6	Formulate and prepare solutions using standard operating procedures (e.g., proper labeling, storage, etc.).
4.2.4	**SAFELY MANAGE AND DISPOSE OF BIOLOGICAL MATERIALS, CHEMICALS, AND WASTES ACCORDING TO STANDARD OPERATING PROCEDURES.**	
	4.2.4.1	Classify different types of personal protective equipment and demonstrate how to properly utilize the equipment.
	4.2.4.2	Classify and describe hazards associated with biological and chemical materials.
	4.2.4.3	Summarize what happens to waste after it leaves the laboratory and identify opportunities to reduce waste and unnecessary costs.
	4.2.4.4	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.
	4.2.4.5	Inventory biological and chemical materials and maintain accurate records of supplies and expiration dates.
	4.2.4.6	Perform waste disposal according to the standard operating procedures.
4.2.5	**EXAMINE AND PERFORM SCIENTIFIC PROCEDURES USING MICROBES, DNA, RNA, AND PROTEINS IN A LABORATORY.**	
	4.2.5.1	Differentiate types of organisms and demonstrate safe handling to maintain organism purity and personal safety (e.g., plant and animal tissue, cell cultures, microbes, etc.).
	4.2.5.2	Compare and contrast the structures of DNA and RNA and investigate how genotype influences phenotype.
	4.2.5.3	Extract and purify DNA and RNA according to standard operating procedures.
	4.2.5.4	Examine and document the role and applications of proteins in agricultural biotechnology.
	4.2.5.5	Synthesize the relationship between proteins, enzymes, and antibodies.
	4.2.5.6	Characterize the physical and biological properties of organisms.
	4.2.5.7	Analyze and interpret the molecular basis for heredity and the tools and techniques used in DNA and RNA manipulations.
	4.2.5.8	Perform electrophoretic techniques and interpret electrophoresis fragmentation patterns (e.g., gel electrophoresis, southern blotting, etc.).

Topic 4.3	***Demonstrate the application of biotechnology to solve problems in Agriculture, Food, and Natural Resources (AFNR) systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).***		
	Student Competencies		
	4.3.1	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO CREATE TRANSGENIC SPECIES THROUGH GENETIC ENGINEERING.**	
		4.3.1.1	Summarize biological, social, agronomic, and economic reasons for genetic modification of eukaryotes.
		4.3.1.2	Summarize the process of transformation of eukaryotic cells with transgenic DNA.
		4.3.1.3	Analyze the benefits and risks associated with the use of biotechnology to increase productivity and improve quality of living species (e.g., plants, animals such as aquatic species, etc.).
		4.3.1.4	Define and summarize epigenetics and synthesize the relationship between mutation, migration, and evolution of transgenes in the environment.
	4.3.2	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO ENHANCE THE PRODUCTION OF FOOD THROUGH THE USE OF MICROORGANISMS AND ENZYMES.**	
		4.3.2.1	Summarize reasons for detecting microbes and identify sources of microbes.
		4.3.2.2	Examine enzymes, the changes they cause and the physical and chemical parameters that affect enzymatic reactions (e.g., food, cellulosic bioenergy, etc.).
		4.3.2.3	Identify and categorize foods produced through the use of biotechnology (e.g., fermentation, etc.) to change the chemical properties of food for an intended purpose (e.g., create desirable nutritional profile, preservation, flavor, etc.).
		4.3.2.4	Assess and describe the use of biotechnology to detect microbes.
	4.3.3	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO PROTECT THE ENVIRONMENT AND MAXIMIZE USE OF NATURAL RESOURCES (E.G., BIOMASS, BIOPROSPECTING, INDUSTRIAL BIOTECHNOLOGY, ETC.).**	
		4.3.3.1	Examine the consequences of agricultural practices on natural populations.
		4.3.3.2	Define and summarize industrial biotechnology and categorize the benefits and risks associated with its use in manufacturing (e.g., fabrics, plastics, etc.).
		4.3.3.3	Research and summarize the potential applications of bioprospecting in biotechnology and agriculture.
		4.3.3.4	Analyze how biotechnology can be used to monitor the effects of agricultural practices on natural populations.
	4.3.4	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO ENHANCE PLANT AND ANIMAL CARE AND PRODUCTION (E.G., SELECTIVE BREEDING, PHARMACEUTICALS, BIODIVERSITY, ETC.).**	
		4.3.4.1	Research and describe the aims and techniques involved in selective plant-breeding process.
		4.3.4.2	Examine and classify biotechnology processes applicable to animal health (e.g., genetic testing, etc.).

		4.3.4.3	Research and categorize the types of pharmaceuticals developed for animals and humans through biotechnology.
		4.3.4.4	Summarize the need for global biodiversity and applications of biotechnology to reduce threats to biodiversity.
	4.3.5	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO PRODUCE BIOFUELS (E.G., FERMENTATION, TRANSESTERIFICATION, METHANOGENESIS, ETC.).**	
		4.3.5.1	Examine and synthesize the need for biofuels (e.g., cellulosic bioenergy, etc.).
		4.3.5.2	Differentiate between biomass and sources of biomass.
		4.3.5.3	Research and explain the process of fermentation and its potential applications.
		4.3.5.4	Define and summarize the process of transesterification and its potential applications.
	4.3.6	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO IMPROVE WASTE MANAGEMENT (E.G., GENETICALLY MODIFIED ORGANISMS, BIOREMEDIATION, ETC.).**	
		4.3.6.1	Compare and contrast the use of natural organisms and genetically-engineered organisms in the treatment of wastes.
		4.3.6.2	Summarize the purpose of microorganisms in biological waste management.
		4.3.6.3	Analyze the role of microorganisms in industrial chemical waste treatment.
		4.3.6.4	Provide examples of instances in which bioremediation can be applied to clean up environmental contaminants.

Standard 6	**FOOD PRODUCTS AND PROCESSING SYSTEMS**	
Topic 6.1	***Develop and implement procedures to ensure safety, sanitation, and quality in food product and processing facilities.***	
	Student Competencies	
	6.1.1	**ANALYZE AND MANAGE OPERATIONAL AND SAFETY PROCEDURES IN FOOD PRODUCTS AND PROCESSING FACILITIES.**
	6.1.1.1	Research and summarize the purposes and objectives of safety programs in food products and processing facilities (e.g., Sanitation Standard Operating Procedures (SSOP); Good Manufacturing Practices (GMP); worker safety, etc.).
	6.1.1.2	Research and categorize types of equipment used in food products and processing systems.
	6.1.1.3	Analyze and document attributes and procedures of current safety programs in food products and processing facilities.
	6.1.1.4	Assess specifications and maintenance needs for equipment and facilities used in food products and processing systems (e.g., specifications for machines, sanitation procedures, repair protocol, etc.).

	6.1.2	**APPLY FOOD SAFETY AND SANITATION PROCEDURES IN THE HANDLING AND PROCESSING OF FOOD PRODUCTS TO ENSURE FOOD QUALITY.**	
		6.1.2.1	Examine and identify contamination hazards associated with food products and processing (e.g., physical, chemical, and biological).
		6.1.2.2	Research and summarize procedures of safe handling protocols (e.g., Hazard Analysis and Critical Control Points Plan (HACCP); Critical Control Point procedures (CCP); Good Agricultural Practices Plan (GAP), etc.).
		6.1.2.3	Research and summarize the purposes and objectives of quality assurance tests on food products (e.g., produce safety regulation, safe food transport, food contaminants, etc.).
		6.1.2.4	Describe the effects foodborne pathogens have on food products and humans.
	6.1.3	**APPLY FOOD SAFETY PROCEDURES WHEN STORING FOOD PRODUCTS TO ENSURE FOOD QUALITY.**	
		6.1.3.1	Identify and summarize purposes of food storage procedures (e.g., first in/first out, temperature regulation, monitoring, etc.).
		6.1.3.2	Research and describe different electronic and paper-based documentation methods used to meet food safety and quality goals in food products and processing systems.
		6.1.3.3	Analyze characteristics of food products and determine appropriate storage procedures.
Topic 6.2	***Apply principles of nutrition, biology, microbiology, chemistry, and human behavior to the development of food products.***		
	Student Competencies		
	6.2.1	**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.**	
		6.2.1.1	Research and summarize properties of common food constituents (e.g., proteins, carbohydrates, fats, vitamins, minerals).
		6.2.1.2	Research and report methods of nutritional planning to meet essential needs for the human diet (e.g., MyPlate).
		6.2.1.3	Compare and contrast the relative value of food constituents relative to food product qualities (e.g., taste, appearance, etc.).
	6.2.2	**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.**	
		6.2.2.1	Examine and describe the basic chemical makeup of different types of food.
		6.2.2.2	Identify common food additives and identify their properties (e.g., preservatives, antioxidants, buffers, stabilizers, colors, flavors, etc.).
		6.2.2.3	Research and summarize the application of biochemistry in the development of new food products (e.g., value added food products, genetically engineered food products, etc.).

	6.2.3	**APPLY PRINCIPLES OF HUMAN BEHAVIOR TO DEVELOP FOOD PRODUCTS TO PROVIDE A SAFE, WHOLESOME, AND NUTRITIOUS FOOD SUPPLY FOR LOCAL AND GLOBAL FOOD SYSTEMS.**	
		6.2.3.1	Examine and explain the importance of food labeling to the consumer.
		6.2.3.2	Research and summarize relevant factors in planning and developing a new food product (e.g., regulation, creativity, economics, etc.).
		6.2.3.3	Examine, interpret, and explain the meaning of required components on a food label.
		6.2.3.4	Determine consumer preference and market potential for a new food product using a variety of methods (e.g., double-blind testing, etc.).
Topic 6.3	***Select and process food products for storage, distribution, and consumption.***		
	Student Competencies		
	6.3.2	**DESIGN AND APPLY TECHNIQUES OF FOOD PROCESSING, PRESERVATION, PACKAGING, AND PRESENTATION FOR DISTRIBUTION AND CONSUMPTION OF FOOD PRODUCTS.**	
		6.3.2.1	Identify and explain English and metric measurements used in the food products and processing industry.
		6.3.2.2	Differentiate between methods and materials used for processing food for different markets (e.g., fresh food products, ready to eat food products, etc.).
		6.3.2.3	Identify methods of food preservation and give examples of foods preserved by each method.
		6.3.2.4	Summarize types of materials and methods used in food packaging and presentation.
	6.3.3	**CREATE FOOD DISTRIBUTION PLANS AND PROCEDURES TO ENSURE SAFE DELIVERY OF FOOD PRODUCTS.**	
		6.3.3.1	Assess and describe the environmental impact of distributing food locally and globally.
		6.3.3.2	Examine the various paths food products take to get from food processing centers to consumers.
Topic 6.4	***Explain the scope of the food industry and the historical and current developments of food product and processing.***		
	Student Competencies		
	6.4.1	**EXAMINE THE SCOPE OF THE FOOD INDUSTRY BY EVALUATING LOCAL AND GLOBAL POLICIES, TRENDS, AND CUSTOMS FOR FOOD PRODUCTION.**	
		6.4.1.1	Research and summarize examples of policy and legislation that affect food products and processing systems in the United States and around the world (e.g., labeling, GMOs, biosecurity, food system policy, dietary guidelines, etc.).
		6.4.1.2	Examine the impact of consumer trends on food products and processing practices (e.g., health and nutrition, organic, information about food products, local food movements, farm-to-fork supply chains, food system transparency, etc.).

	6.4.2	**EVALUATE THE SIGNIFICANCE AND IMPLICATIONS OF CHANGES AND TRENDS IN THE FOOD PRODUCTS AND PROCESSING INDUSTRY IN THE LOCAL AND GLOBAL FOOD SYSTEMS.**	
		6.4.2.1	Describe and explain the components of the food products and processing industry (e.g., processing, distribution, byproducts, etc.).
		6.4.2.2	Identify and explain environmental and safety concerns about the food supply.
	6.4.3	**IDENTIFY AND EXPLAIN THE PURPOSE OF INDUSTRY ORGANIZATIONS, GROUPS, AND REGULATORY AGENCIES THAT INFLUENCE THE LOCAL AND GLOBAL FOOD SYSTEMS.**	
		6.4.3.1	Examine and summarize the purposes of organizations that influence or regulate the food products and processing industry.
		6.4.3.2	Examine and describe the importance and usage of regulatory oversight of food safety and security in food products and processing (e.g., internationally, nationally, state, and local).

Standard 8	**PLANT SYSTEMS**		
Topic 8.3	***Propagate, culture, and harvest plants and plant products based on current industry standards.***		
	Student Competencies		
	8.3.1	**DEMONSTRATE PLANT PROPAGATION TECHNIQUES IN PLANT SYSTEM ACTIVITIES.**	
		8.3.1.1	Identify examples of and summarize pollination, cross-pollination, and self-pollination of flowering plants.
		8.3.1.2	Demonstrate sowing techniques for providing favorable conditions to meet the factors of seed germination.
		8.3.1.3	Summarize optimal conditions for asexual propagation and demonstrate techniques used to propagate plants by cuttings, division, separation, layering, budding, and grafting.
		8.3.1.4	Define micropropagation, discuss advantages associated with the practice, and summarize the main stages of the process.
		8.3.1.5	Summarize the principles of recombinant DNA technology and the basic steps in the process.
		8.3.1.6	Examine and apply the process of plant pollination and/or fertilization.

	8.3.2	**DEVELOP AND IMPLEMENT A MANAGEMENT PLAN FOR PLANT PRODUCTION.**	
		8.3.2.1	Research and summarize the importance of starting with pest- and disease-free propagation material.
		8.3.2.2	List and summarize the reasons for preparing growing media before planting.
		8.3.2.3	Determine seeding rate need for specified plant population or desired quantity of finished plants.
		8.3.2.4	Observe and record environmental conditions during the germination, growth, and development of a crop.
	8.3.3	**DEVELOP AND IMPLEMENT A PLAN FOR INTEGRATED PEST MANAGEMENT FOR PLANT PRODUCTION.**	
		8.3.3.1	Identify and categorize plant pests, diseases, and disorders.
		8.3.3.2	Diagram the life cycle of major plant pests and diseases.
		8.3.3.3	Identify and summarize pest control strategies associated with integrated pest management and the importance of determining economic threshold.
		8.3.3.4	Distinguish between risks and benefits associated with the materials and methods used in plant pest management.
	8.3.4	**APPLY PRINCIPLES AND PRACTICES OF SUSTAINABLE AGRICULTURE TO PLANT PRODUCTION.**	
		8.3.4.1	Compare and contrast the alignment of different production systems (conventional and organic) with USDA sustainable practices criteria.
		8.3.4.2	Summarize national/international and local/regional food production systems.
	8.3.5	**HARVEST, HANDLE, AND STORE CROPS ACCORDING TO CURRENT INDUSTRY STANDARDS.**	
		8.3.5.1	Identify and summarize harvesting methods and equipment.
		8.3.5.2	Research and summarize reasons for calculating crop loss and or damage.
		8.3.5.3	Research and summarize how safety is ensured at each stage of the following processes: harvesting, processing, and storing.

Career Ready Practices (CRP)		
	CRP 1	**Act as a responsible and contributing citizen and employee.**
	CRP 2	**Apply appropriate academic and technical skills.**
	CRP 3	**Attend to personal health and financial well-being.**
	CRP 4	**Communicate clearly, effectively, and with reason.**
	CRP 5	**Consider the environmental, social, and economic impacts of decisions.**
	CRP 6	**Demonstrate creativity and innovation.**
	CRP 7	**Employ valid and reliable research strategies.**
	CRP 8	**Utilize critical thinking to make sense of problems and persevere in solving them.**
	CRP 9	**Model integrity, ethical leadership, and effective management.**
	CRP 10	**Plan education and career path aligned to personal goals.**
	CRP 11	**Use technology to enhance productivity.**
	CRP 12	**Work productively in teams while using cultural/global competence.**
	OTHER	
1	**FFA Student Handbook/Leadership**	
	1.1	**Explain aims and purposes of FFA.**
	1.2	**Explain importance of FFA as part of the Agriculture Education program.**
	1.5	**Describe opportunities available to FFA members.**
	1.6	**Define leadership.**
	1.7	**Explain the importance of effective leadership in agriculture.**
2	**Supervised Agricultural Experience (SAE)**	
	2.1	**Define SAE.**
	2.2	**Explain importance of SAE as part of the Agriculture Education program.**
	2.3	**Explain different types of SAEs (e.g. entrepreneur, placement, experimental research, non-experimental research, exploratory, directed activities, and improvement.**
	2.4	**Identify basic record book functions (e.g. goal setting, plan of action, leadership in FFA, community involvement).**
	2.5	**Explain goal setting.**
	2.6	**Write goals.**