FOUNDATIONS OF AGRICULTURE

#01012

Description

This applied course is designed to enhance student's perception of agriculture, its applications, and leadership development as the core foundation of the Agriculture Education program. Individual units will familiarize the student with: basic mechanical theory and skills – emphasis will be placed on safety and proper use of tools and equipment; principles of evaluation and selection of beef, swine, sheep, horse, and dairy animals; soil and plant relationships that affect the production of food and fiber. Topics may include: soils, irrigation, land judging, plants, crop and weed identification, range management, horticulture, nursery, diseases, insects, and chemicals.

This applied course introduces students to agricultural sciences with emphasis on technical skills, entrepreneurship, and occupational opportunities. Units may also include agricultural construction, food and fiber science, supervised agricultural experiences, and leadership development.

Agricultural mechanics units are designed to further develop skills in selection, operation, and maintenance of engines, hydraulics, and agricultural machinery and tractors. Skills in operation and maintenance of equipment, determining a bill of materials, construction techniques, metal fabrication, and joining processes of metals and alloys will be included.

Emphasis is on problem solving and scientific reasoning applied to real world problems integrating knowledge from the life and earth sciences. Foundations of Agriculture can be a continuation of Introduction of Agriculture or can be offered in alternating years with Introduction to Agriculture.

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.
	1.3.3	**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.

Standard 2	**AGRIBUSINESS SYSTEMS**		
Topic 2.2	***Use record keeping to accomplish AFNR business objectives, manage budgets, and comply with laws and regulations.***		
	Student Competencies		
	2.2.1	**APPLY FUNDAMENTAL ACCOUNTING PRINCIPLES, SYSTEMS, TOOLS, AND APPLICABLE LAWS AND REGULATIONS TO RECORD, TRACK, AND AUDIT AFNR BUSINESS TRANSACTIONS (E.G., ACCOUNTS, DEBITS, CREDITS, ASSETS, LIABILITIES, EQUITY, ETC.).**	
		2.2.1.1	Examine and describe accounting systems and procedures used for record keeping in AFNR businesses (e.g., cash vs. accrual systems, identification of appropriate accounts, double-entry accounting, entry of debits and credits, etc.).
		2.2.1.2	Research and summarize the features of different tools and services for recording, tracking, and auditing AFNR business transactions (e.g., electronic tools, paper-based tools, consultative services, online services, banking services, etc.).
		2.2.1.3	Research and examine the implications of applicable laws and regulations related to recording, tracking, and auditing AFNR business transactions (e.g., Generally Accepted Accounting Principles, data security, etc.).

	2.2.2	**ASSEMBLE, INTERPRET, AND ANALYZE FINANCIAL INFORMATION AND REPORTS TO MONITOR AFNR BUSINESS PERFORMANCE AND SUPPORT DECISION-MAKING (E.G., INCOME STATEMENTS, BALANCE SHEETS, CASH-FLOW ANALYSIS, INVENTORY REPORTS, BREAK-EVEN ANALYSIS, RETURN ON INVESTMENT, TAXES, ETC.).**	
		2.2.2.1	Compare and contrast the different types of financial reports (e.g., income statements, cash flow statements, equity statements, etc.) and their frequency of use (e.g., daily, weekly, monthly, quarterly, annual) for monitoring AFNR business performance.
		2.2.2.2	Research and summarize strategies for tracking, reporting and managing inventory in AFNR businesses (e.g., spreadsheets, databases, word processing, networked systems, the Internet, etc.).
		2.2.2.3	Define and classify different types of taxes that may be paid by AFNR businesses (e.g., income, property, sales, employment, estate, etc.).
Topic 2.3	***Manage cash budgets, credit budgets, and credit for an AFNR business using generally accepted accounting principles.***		
	Student Competencies		
	2.3.1	**DEVELOP, ASSESS, & MANAGE CASH BUDGETS TO ACHIEVE AFNR BUSINESS GOALS.**	
		2.3.1.3	Examine and interpret cash budgets for AFNR businesses.
		2.3.1.4	Examine and identify strategies to manage components of cash budgets to minimize liabilities and maximize profit in AFNR businesses (e.g., delayed payment of expenses, prepayment of expenses, etc.).
		2.3.1.5	Develop cash budgets for AFNR businesses.
		2.3.1.6	Predict the impact of management decisions on cash budgets in AFNR businesses.
	2.3.2	**ANALYZE CREDIT NEEDS AND MANAGE CREDIT BUDGETS TO ACHIEVE AFNR BUSINESS GOALS.**	
		2.3.2.3	Analyze AFNR business needs to determine the necessity of loans for business operation.
		2.3.2.4	Compare and contrast strategies to responsibly manage credit budgets in AFNR businesses.
		2.3.2.5	Analyze and assemble the information needed to obtain credit for AFNR businesses.
		2.3.2.6	Analyze AFNR business needs and recommend appropriate uses of available credit budgets to meet goals.

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 3.2	***Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.***		
	Student Competencies		
	3.2.1	**DEMONSTRATE MANAGEMENT TECHNIQUES THAT ENSURE ANIMAL WELFARE.**	
		3.2.1.4	Design programs that assure the welfare of animals and prevent abuse or mistreatment.
		3.2.1.5	Analyze and document animal welfare procedures used to ensure safety and maintain low stress when moving and restraining animals.
		3.2.1.6	Analyze and document animal husbandry practices and their impact on animal welfare.
	3.2.2	**ANALYZE PROCEDURES TO ENSURE THAT ANIMAL PRODUCTS ARE SAFE FOR CONSUMPTION (E.G., USE IN FOOD SYSTEM, ETC.).**	
		3.2.2.4	Utilize tools, technology, and equipment to perform animal husbandry and welfare tasks.
		3.2.2.5	Analyze consumer concerns with animal production practices relative to human health.
		3.2.2.6	Analyze and summarize the impact of animal trace-back capabilities on producers and consumers.

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.
	3.3.2	**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.
	3.3.3	**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.
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.).
Topic 3.6	***Classify, evaluate, and select animals based on anatomical and physiological characteristics.***		
	Student Competencies		
	3.6.1	**CLASSIFY ANIMALS ACCORDING TO TAXONOMIC CLASSIFICATION SYSTEMS AND USE (E.G. AGRICULTURAL, COMPANION, ETC.).**	
		3.6.1.4	Explain how animals are classified using a taxonomic classification system.
		3.6.1.5	Appraise and evaluate the economic value of animals for various applications in the agriculture industry.
	3.6.2	**APPLY PRINCIPLES OF COMPARATIVE ANATOMY AND PHYSIOLOGY TO USES WITHIN VARIOUS ANIMAL SYSTEMS.**	
		3.6.2.4	Analyze the functions of each animal cell structure.
		3.6.2.5	Analyze the processes of meiosis and mitosis in animal growth, development, health, and reproduction.
		3.6.2.6	Compare and contrast animal cells, tissues, organs, body systems types, and functions among animal species.
		3.6.2.7	Correlate the functions of animal cell structures to animal growth, development, health, and reproduction.
		3.6.2.8	Apply the processes of meiosis and mitosis to solve animal growth, development, health, and reproductive problems.
		3.6.2.9	Apply knowledge of anatomical and physiological characteristics of animals to make production and management decisions.
	3.6.3	**SELECT AND TRAIN ANIMALS FOR SPECIFIC PURPOSES AND MAXIMUM PERFORMANCE BASED ON ANATOMY AND PHYSIOLOGY.**	
		3.6.3.4	Compare and contrast desirable anatomical and physiological characteristics of animals within and between species.
		3.6.3.5	Compare and contrast procedures to sustainably and efficiently develop an animal to reach its highest performance potential with respect to its anatomical and physiological characteristics.
		3.6.3.6	Evaluate and select products from animals based on industry standards.
Topic 3.8	***Analyze environmental factors associated with animal production.***		
	Student Competencies		
	3.8.1	**DESIGN AND IMPLEMENT METHODS TO REDUCE THE EFFECTS OF ANIMAL PRODUCTION ON THE ENVIRONMENT.**	
		3.8.1.1	Identify and summarize the effects of animal agriculture on the environment (e.g., waste disposal, carbon footprint, air quality, environmental efficiencies, etc.).

	3.8.2	**EVALUATE THE EFFECTS OF ENVIRONMENTAL CONDITIONS ON ANIMALS AND CREATE PLANS TO ENSURE FAVORABLE ENVIRONMENTS FOR ANIMALS.**	
		3.8.2.1	Research and summarize environmental conditions that impact animals (e.g., weather, sources of water, food resources, etc.).
		3.8.2.2	Identify and summarize methods for ensuring optimal environmental conditions for animals.

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.).**	
		4.1.1.5	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).**	
		4.1.3.4	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.).
	4.2.2	**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.).
	4.2.3	**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.).
	4.2.4	**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.

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.
		4.3.1.5	Analyze and document the processes and describe the techniques used to produce transgenic eukaryotes (e.g., microbial synthetic biology, gene knockout therapy, traditional gene insertion, etc.).
		4.3.1.6	Assess and argue the pros and cons of transgenic species in agriculture.
		4.3.1.7	Research and evaluate genetic engineering procedures used in the production of living species.

Standard 5	ENVIRONMENTAL SERVICE SYSTEMS		
Topic 5.2	***Evaluate the impact of public policies and regulations on environmental service system operations.***		
	Student Competencies		
	5.2.3	**EXAMINE AND SUMMARIZE THE IMPACT OF PUBLIC PERCEPTIONS AND SOCIAL MOVEMENTS ON THE REGULATION OF ENVIRONMENTAL SERVICE SYSTEMS.**	
		5.2.3.1	Research and summarize how the perception and regulation of environmental service systems has changed over time.
		5.2.3.2	Examine how social views and movements (e.g., zero-waste philosophy, carbon footprints, recycling, etc.) have affected the implementation and need for regulation of environmental service systems.
Topic 5.3	***Develop proposed solutions to environmental issues, problems, and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry, and ecology.***		
	Student Competencies		
	5.3.5	**APPLY ECOLOGY PRINCIPLES TO ENVIRONMENTAL SERVICE SYSTEMS.**	
		5.3.5.5	Calculate the amount of biodiversity in a given area using an appropriate method (e.g., quadrat assessment, transect measurements, etc.).
		5.3.5.6	Assess the impact of the current rate of habitat loss on environmental service systems.
		5.3.5.7	Assess and describe the impact of a population exceeding its carrying capacity on environmental service systems.
		5.3.5.8	Evaluate the benefits and drawbacks of using bioindicator species in environmental service systems.
Topic 5.5	***Use tools, equipment, machinery, & technology common to tasks in environmental service systems.***		
	Student Competencies		
	5.5.1	**USE TECHNOLOGICAL AND MATHEMATICAL TOOLS TO MAP LAND, FACILITIES AND INFRASTRUCTURE FOR ENVIRONMENTAL SERVICE SYSTEMS.**	
		5.5.1.1	Examine the importance and describe applications of surveying and mapping for environmental service systems.
		5.5.1.2	Research the methods in which GIS can be used in environmental service systems (e.g., tracing of point pollution, control of the spread of invasive species, etc.).
		5.5.1.3	Research how advancements in technology (e.g., unmanned aerial vehicles and drones, genetic modification, fracking, alternative energy, etc.) have changed environmental service systems.

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.
	6.1.3	**APPLY FOOD SAFETY PROCEDURES WHEN STORING FOOD PRODUCTS TO ENSURE FOOD QUALITY.**	
		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.
		6.1.3.4	Demonstrate and explain methods of documentation procedures within food products and processing systems.

Standard 7	NATURAL RESOURCE SYSTEMS		
Topic 7.1	***Plan and conduct natural resource management activities that apply logical, reasoned, and scientifically based solutions to natural resource issues and goals.***		
	Student Competencies		
	7.1.1	**APPLY METHODS OF CLASSIFICATION TO EXAMINE NATURAL RESOURCE AVAILABILITY AND ECOSYSTEM FUNCTION IN A PARTICULAR REGION.**	
		7.1.1.4	Assess the characteristics of a natural resource to determine its classification.
		7.1.1.5	Analyze the interdependence of organisms within an ecosystem (e.g., food webs, niches, impact of keystone species, etc.) and assess the dependence of organisms on nonliving components (climate, geography, energy flow, nutrient cycling, etc.).
		7.1.1.6	Analyze how biodiversity develops through evolution, natural selection, and adaptation; explain the importance of biodiversity to ecosystem function and availability of natural resources.

	7.1.2	**CLASSIFY DIFFERENT TYPES OF NATURAL RESOURCES IN ORDER TO ENABLE PROTECTION, CONSERVATION, ENHANCEMENT, AND MANAGEMENT IN A PARTICULAR GEOGRAPHICAL REGION.**	
		7.1.2.7	Apply identification techniques to determine the species of a tree or woody plant.
		7.1.2.8	Apply identification techniques to determine the species of an herbaceous plant.
		7.1.2.9	Apply identification techniques to determine the species of wildlife or insect.
		7.1.2.10	Apply identification techniques to determine the species of an aquatic organism.
		7.1.2.11	Apply identification techniques to determine the types of non-living resources in an area.
		7.1.2.12	Apply procedures for conducting resource inventories and population studies.
	7.1.3	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO ATMOSPHERIC NATURAL RESOURCE SYSTEMS.**	
		7.1.3.1	Classify different kinds of biogeochemical cycles and the role they play in natural resources systems.
		7.1.3.2	Research and summarize how climate factors influence natural resource systems.
		7.1.3.3	Assess the role that the atmosphere plays in the regulation of biogeochemical cycles.
		7.1.3.4	Analyze the impact that climate has on natural resources and debate how this impact has changed due to human activity.
	7.1.4	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO AQUATIC NATURAL RESOURCE SYSTEMS.**	
		7.1.4.1	Summarize the roles and properties of watersheds.
		7.1.4.2	Examine and describe the importance of groundwater and surface water to natural resources.
		7.1.4.3	Compare and contrast riparian zones and riparian buffers based on their function.
	7.1.5	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO TERRESTRIAL NATURAL RESOURCE SYSTEMS.**	
		7.1.5.5	Analyze and summarize examples of stages of succession.
		7.1.5.6	Analyze and summarize examples of habitat disturbances and habitat resilience.
		7.1.5.7	Analyze a forest in order to determine which forestry techniques would improve that habitat.
		7.1.5.8	Analyze a plot of land in order to determine which soil management techniques would be most applicable.
	7.1.6	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO LIVING ORGANISMS IN NATURAL RESOURCE SYSTEMS.**	
		7.1.6.1	Differentiate between population ecology, population density, and population dispersion and describe the importance of these concepts to natural resource systems.
		7.1.6.2	Research and summarize examples of invasive species.

Topic 7.2	***Analyze the interrelationships between natural resources and humans.***	
	Student Competencies	
	7.2.1	**EXAMINE & INTERPRET THE PURPOSE, ENFORCEMENT, IMPACT, & EFFECTIVENESS OF LAWS & AGENCIES RELATED TO NATURAL RESOURCE MANAGEMENT, PROTECTION, ENHANCEMENT, & IMPROVEMENT (E.G., WATER REGULATIONS, GAME LAWS, HISTORIC PRESERVATION LAWS, ENVIRONMENTAL POLICY, ETC.).**
	7.2.1.1	Distinguish between the types of laws associated with natural resources systems.
	7.2.1.2	Distinguish between the types of agencies associated with natural resources systems.
	7.2.1.3	Analyze the structure of laws associated with natural resources systems.
	7.2.1.4	Analyze the specific purpose of agencies associated with natural resources systems.
	7.2.2	**ASSESS THE IMPACT OF HUMAN ACTIVITIES ON THE AVAILABILITY OF NATURAL RESOURCES.**
	7.2.2.4	Assess and explain how different kinds of human activity affect the use and availability of natural resources (i.e., agriculture, industry, transportation, etc.).
	7.2.2.5	Assess causes of extinction and describe how those causes related to loss of biodiversity.
	7.2.2.6	Identify solutions to improve the sustainability of modern lifestyles.
	7.2.4	**EXAMINE AND EXPLAIN HOW ECONOMICS AFFECTS THE USE OF NATURAL RESOURCES.**
	7.2.4.1	Compare and contrast how the economic value of a natural resource affects its availability.
	7.2.4.2	Research the impact of the use of natural resources on local, state and national economies (e.g., outdoor recreation, energy production, preservation, etc.).
	7.2.4.3	Compare and contrast the economic impact of green technology and alternative energy.
	7.2.5	**COMMUNICATE INFORMATION TO THE PUBLIC REGARDING TOPICS RELATED TO THE MANAGEMENT, PROTECTION, ENHANCEMENT, AND IMPROVEMENT OF NATURAL RESOURCES.**
	7.2.5.1	Examine and describe ways in which a message regarding natural resources may be communicated to the public through standard media sources (e.g., press, radio, TV, public appearances, etc.).
	7.2.5.2	Research and summarize how social media and the Internet have changed how people perceive and utilize natural resources (e.g., greater awareness of conservation issues, calls to action, etc.).
	7.2.5.3	Examine and describe 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.

Standard 8	PLANT SYSTEMS		
Topic 8.1	***Develop and implement a crop management plan for a given production goal that accounts for environmental factors.***		
	Student Competencies		
	8.1.1	**DETERMINE THE INFLUENCE OF ENVIRONMENTAL FACTORS ON PLANT GROWTH.**	
		8.1.1.1	Identify and summarize the three measurements of light – color, intensity, and duration – that affect plant growth.
		8.1.1.2	Identify and summarize the effects of air and temperature on plant metabolism and growth.
		8.1.1.3	Identify and summarize the effects of water quality on plant growth (e.g., pH, dissolved solids, etc.).
	8.1.2	**PREPARE AND MANAGE GROWING MEDIA FOR USE IN PLANT SYSTEMS.**	
		8.1.2.1	Identify the major components of growing media and describe how growing media support plant growth.
		8.1.2.2	Identify the categories of soil water.
	8.1.3	**DEVELOP AND IMPLEMENT A FERTILIZATION PLAN FOR SPECIFIC PLANTS OR CROPS.**	
		8.1.3.1	Identify the essential nutrients for plant growth and development and their major functions (e.g., nitrogen, phosphorous, potassium, etc.).
		8.1.3.2	Discuss the influence of pH and cation exchange capacity on the availability of nutrients.
		8.1.3.3	Collect soil and plant tissue samples using generally accepted procedures and explain how incorrect sample collection will affect the results of a laboratory analysis.
		8.1.3.4	Identify fertilizer sources of essential plant nutrients; explain fertilizer formulations, including organic and inorganic; and describe different methods of fertilizer application.
		8.1.3.5	Research and summarize production methods focused on soil management (e.g., crop rotation, companion planting, cover crops, etc.).
		8.1.3.6	Summarize the impact of environmental factors on nutrient availability (e.g., moisture, temperature, pH, etc.).
Topic 8.2	***Apply principles of classification, plant anatomy, and plant physiology to plant production and management.***		
	Student Competencies		
	8.2.1	**CLASSIFY PLANTS ACCORDING TO TAXONOMIC SYSTEMS.**	
		8.2.1.3	Compare and contrast the hierarchical classification of agricultural and ornamental plants.
		8.2.1.4	Identify and describe important plants to agricultural and ornamental plant systems by common names.
	8.2.2	**APPLY KNOWLEDGE OF PLANT ANATOMY AND THE FUNCTIONS OF PLANT STRUCTURES TO ACTIVITIES ASSOCIATED WITH PLANT SYSTEMS.**	
		8.2.2.7	Compare and contrast mitosis and meiosis.
		8.2.2.8	Analyze root tissues and explain the pathway of water and nutrients into and through root tissues.

	8.2.2.9	Analyze and describe the difference in arrangement of vascular tissue between monocot and dicot plant stems.
	8.2.2.10	Analyze how leaves capture light energy and summarize the exchange of gases.
	8.2.2.11	Apply knowledge of flower structure to differentiate between the types of flowers and flower inflorescence (e.g., complete, incomplete, perfect, imperfect).
	8.2.2.12	Analyze and categorize the major types of seeds and fruit.
	8.2.2.13	Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems.
	8.2.2.14	Correlate the active and passive transport of minerals into and through the root system to plant nutrition.
	8.2.2.15	Evaluate the function of the xylem, phloem, and cambium tissues and the impact on plant systems.
8.2.3	**APPLY KNOWLEDGE OF PLANT PHYSIOLOGY AND ENERGY CONVERSION TO PLANT SYSTEMS.**	
	8.2.3.6	Apply knowledge of photosynthesis to analyze how various environmental factors will affect the rate of photosynthesis.
	8.2.3.7	Analyze the factors that affect cellular respiration processes and rate in a crop production setting.
	8.2.3.8	Analyze plant growth and assess the process of secondary plant growth.
	8.2.3.9	Analyze and identify the plant responses to plant growth regulators and different forms of tropism.
	8.2.3.10	Identify and analyze the factors affecting transpiration, translocation, and assimilation rate and products.

Standard 9	POWER, STRUCTURAL, AND TECHNICAL SYSTEMS		
Topic 9.1	***Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.***		
	Student Competencies		
	9.1.1	**APPLY PHYSICAL SCIENCE AND ENGINEERING PRINCIPLES TO ASSESS AND SELECT ENERGY SOURCES FOR AFNR POWER, STRUCTURAL, AND TECHNICAL SYSTEMS.**	
		9.1.1.4	Assess the environmental impacts of renewable and nonrenewable energy sources used in AFNR.
		9.1.1.5	Calculate the costs of using renewable and nonrenewable energy sources in an AFNR enterprise or business.
		9.1.1.6	Convert energy utilized in an AFNR structure to an energy utilization index (e.g., convert CCF, KWH, etc. to Btu consumption per square foot, etc.).
	9.1.2	**APPLY PHYSICAL SCIENCE AND ENGINEERING PRINCIPLES TO DESIGN, IMPLEMENT, AND IMPROVE SAFE AND EFFICIENT MECHANICAL SYSTEMS IN AFNR SITUATIONS.**	
		9.1.2.4	Perform mathematical calculations to determine the mechanical advantage of simple machines in AFNR related mechanical systems.
		9.1.2.5	Calculate the maintenance and purchase cost of tools, machines, and equipment used in AFNR.
		9.1.2.6	Select, maintain, and demonstrate the proper use of tools, machines, and equipment used in different AFNR related mechanical systems.
	9.1.3	**APPLY PHYSICAL SCIENCE PRINCIPLES TO METAL FABRICATION USING A VARIETY OF WELDING AND CUTTING PROCESSES (E.G., SMAW, GMAW, GTAW, FUEL-OXYGEN AND PLASMA ARC TORCH, ETC.).**	
		9.1.3.3	Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.
		9.1.3.4	Assess and select the proper electrode for use in various shielded metal arc welding situations.
Topic 9.2	***Operate and maintain AFNR mechanical equipment and power systems.***		
	Student Competencies		
	9.2.1	**PERFORM PREVENTATIVE MAINTENANCE AND SCHEDULED SERVICE TO MAINTAIN EQUIPMENT, MACHINERY, AND POWER UNITS USED IN AFNR SETTINGS.**	
		9.2.1.3	Develop a preventative maintenance schedule for equipment, machinery, and power units used in AFNR power, structural, and technical systems.
		9.2.1.4	Service filtration systems and maintain fluid levels on equipment, machinery, and power units in accordance with operator's manuals.

	9.2.2	**OPERATE MACHINERY AND EQUIPMENT WHILE OBSERVING ALL SAFETY PRECAUTIONS IN AFNR SETTINGS.**	
		9.2.2.3	Analyze and calculate the cost of using equipment, machinery, and power units for AFNR power, structural, and technical systems.
		9.2.2.4	Apply safety principles and applicable regulations to operate equipment, machinery, and power units used in AFNR power, structural, and technical systems.
Topic 9.4	***Plan, build, and maintain AFNR structures.***		
	Student Competencies		
	9.4.1	**CREATE SKETCHES AND PLANS FOR AFNR STRUCTURES.**	
		9.4.1.3	Apply scale measurement and dimension to develop sketches of agricultural structures.
		9.4.1.4	Construct plans for agricultural structures using current technology (e.g., drafting software, computer-aided design, etc.).
	9.4.2	**DETERMINE STRUCTURAL REQUIREMENTS, SPECIFICATIONS, AND ESTIMATE COSTS FOR AFNR STRUCTURES**	
		9.4.2.3	Analyze a project plan to prepare a bill of materials and an estimate of material costs.

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.**