



BOTANY/HORTICULTURAL SCIENCE I

#01053

Description

These courses prepare students to produce greenhouse/nursery plants and to maintain plant growth and propagation structures. Topics to be covered include: soils, plants, plant identification, and plant entomology. Courses examine the importance of plant cell structures, functions of cells, plant processes, nonvascular plants, vascular plants, roots, stems, leaves, flowers, and reproduction of plants. Students may be introduced to the biological, environmental, conservation, and ecological concepts encountered in our environment. Landscape design units will prepare students to design, construct, and maintain planted areas and devices for the beautification of home grounds and other areas of human habitation and recreation. These courses will reinforce and extend students' understanding of science by associating basic scientific principles and concepts with relevant applications in agriculture. Leadership development and supervised agricultural experience programs are also an integral part of this course.

Note: These courses can be taught for Agricultural Education credit only. For Science credit, Botany/Horticultural Science I can be found under Science.

Grade 9-12

½ or 1 credit

Max Credit = 1

Standard 1	AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) CLUSTER SKILLS	
Topic 1.1	<i>Analyze how issues, trends, technologies, and public policies impact systems in the Agriculture, Food, & Natural Resources Career Cluster.</i>	
Student Competencies		
	1.1.1	RESEARCH, EXAMINE, AND DISCUSS ISSUES AND TRENDS THAT IMPACT AFNR SYSTEMS ON LOCAL, STATE, NATIONAL, AND GLOBAL LEVELS.
	1.1.1.1	Examine historical and current data to identify issues impacting AFNR systems.
	1.1.1.2	Research and summarize trends impacting AFNR systems.
	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.
	1.1.2.1	Research technologies used in AFNR systems.
	1.1.2.2	Compare and contrast AFNR systems before and after the integration of technology.
	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.
	1.1.3.1	Summarize public policies affecting AFNR systems.
	1.1.3.2	Identify influential historical and current public policies that impact 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	<i>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.</i>	
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.).
	1.2.1.3	Analyze and interpret AFNR related geographic data using a variety of systems and technologies (e.g., GIS, GPS, etc.).
	1.2.1.4	Analyze and interpret a set of economic data and explain how it impacts an AFNR system.

	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.).
		1.2.2.4	Assess components within AFNR systems and analyze relationships between systems.
		1.2.2.5	Assess how people within societies on local, state, national, and global levels interact with AFNR systems on daily, monthly, or yearly basis.
		1.2.2.6	Assess the economic impact of an AFNR system on a local, state, national, and global level.
Topic 1.3	<i>Examine and summarize the importance of health, safety, and environmental management systems in AFNR workplaces.</i>		
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.
		1.3.1.4	Analyze existing required regulations within an AFNR workplace.
	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.
		1.3.2.4	Develop plans to improve environmental compliance and performance within an AFNR system.
	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.
		1.3.3.5	Analyze and evaluate the impact of current health and safety practices of AFNR workplaces.

	1.3.3.6	Assess various emergency response plan requirements for an AFNR workplaces and/or facility.
	1.3.3.7	Assess and apply first aid knowledge and procedures relevant to AFNR workplaces.
	1.3.3.8	Assess the safety priorities and select appropriate responses for different levels of contamination or injury at an AFNR 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.
	1.3.4.5	Complete the set up and adjustment for tools and equipment related to AFNR tasks.
	1.3.4.6	Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
Topic 1.4	<i>Demonstrate stewardship of natural resources in AFNR activities.</i>	
	Student Competencies	
	1.4.1	IDENTIFY AND IMPLEMENT PRACTICES TO STEWARD NATURAL RESOURCES IN DIFFERENT AFNR SYSTEMS.
	1.4.1.1	Define stewardship of natural resources and distinguish how it connects to AFNR systems.
	1.4.1.2	Read and interpret the definition of sustainability and summarize how it relates to AFNR activities.
	1.4.1.3	Analyze available practices to steward natural resources in AFNR systems (e.g., wildlife and land conservation, soil and water practices, ecosystem management, etc.).
	1.4.1.4	Analyze and assess sustainability practices that can be applied in AFNR systems (e.g., energy efficiency, recycle/reuse/repurpose, green resources, etc.).
	1.4.2	ASSESS AND EXPLAIN THE NATURAL RESOURCE RELATED TRENDS, TECHNOLOGIES, AND POLICIES THAT IMPACT AFNR SYSTEMS.
	1.4.2.1	Research and examine historical and current natural resources trends and technologies.
	1.4.2.2	Research and summarize influential historical and current natural resources policies that impact AFNR systems.
	1.4.2.3	Analyze natural resources trends and technologies and explain how they impact AFNR systems (e.g., climate change, green technologies, water resources, etc.).
	1.4.2.4	Create and defend a hypothetical natural resources policy that will impact current AFNR systems (e.g., for water resources, land use, air quality, etc.).

Topic 1.5	<i>Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food, & Natural Resources career pathways.</i>	
	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.).
	1.5.1.1	Identify and summarize the steps to pursue a career in an AFNR pathway (e.g., self-assessment, set goals, etc.).
	1.5.1.2	Examine the educational, training, and experiential requirements to pursue a career in an AFNR pathway (e.g., degrees, certifications, training, internships, 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.
	1.5.1.6	Assess personal goals, experiences, education, and skillsets and organize them to produce the appropriate tools and develop the skills to effectively communicate about one's qualifications for an AFNR career.
	1.5.2	EXAMINE AND CHOOSE CAREER OPPORTUNITIES THAT ARE MATCHED TO PERSONAL SKILLS, TALENTS, AND CAREER GOALS IN AN AFNR PATHWAY OF INTEREST.
	1.5.2.1	Examine and categorize careers in each of the AFNR pathways.
	1.5.2.2	Research and describe careers in each of the AFNR pathways and choose potential careers connecting to personal interests and skills.
	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	<i>Analyze the interaction among AFNR systems in the production, processing, and management of food, fiber, and fuel and the sustainable use of natural resources.</i>	
	Student Competencies	
	1.6.1	EXAMINE AND EXPLAIN FOUNDATIONAL CYCLES AND SYSTEMS OF AFNR.
	1.6.1.1	Research and explain the foundational cycles in AFNR (e.g., water cycle, nutrient cycle, carbon cycle, etc.).
	1.6.1.2	Examine and describe examples of systems within AFNR (e.g., sustainability, gate-to-plate, etc.).
	1.6.2	ANALYZE AND EXPLAIN THE CONNECTION AND RELATIONSHIPS BETWEEN DIFFERENT AFNR SYSTEMS ON A NATIONAL AND GLOBAL LEVEL.
	1.6.2.1	Summarize how AFNR systems connect and relate on a national and global level (e.g., soil, water, economic, etc.).

	1.6.2.2	Examine and summarize changes that happen in AFNR systems on a national and global level (e.g., using less irrigation water, reduction of inputs, etc.).
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Standard 2	AGRIBUSINESS SYSTEMS	
Topic 2.1	<i>Apply management planning principles in AFNR businesses.</i>	
	Student Competencies	
	2.1.1	APPLY MICRO- AND MACROECONOMIC PRINCIPLES TO PLAN AND MANAGE INPUTS AND OUTPUTS IN AN AFNR BUSINESS.
	2.1.1.1	Examine and provide examples of microeconomic principles related to decisions about AFNR business inputs and outputs (e.g., supply, demand and equilibrium, elasticity, diminishing returns, opportunity cost, etc.).
	2.1.1.2	Examine and provide examples of macroeconomic principles related to AFNR businesses (e.g., Gross Domestic Product, inflation, capital accounts, unemployment rate, etc.).
	2.1.1.3	Define and research the nature of monetary policies in different global economic systems (e.g., traditional economic system, command economic system, market economic system, mixed economic system, etc.).
	2.1.2	READ, INTERPRET, EVALUATE AND WRITE STATEMENTS OF PURPOSE TO GUIDE BUSINESS GOALS, OBJECTIVES, AND RESOURCE ALLOCATION.
	2.1.2.1	Read and interpret statements of purpose (e.g., vision, mission statement, charter, etc.).
	2.1.2.2	Identify the meaning and importance of goals and objectives in AFNR business enterprises.
	2.1.3	DEVISE AND APPLY MANAGEMENT SKILLS TO ORGANIZE AND RUN AN AFNR BUSINESS IN AN EFFICIENT, LEGAL, AND ETHICAL MANNER.
	2.1.3.1	Define and provide examples of management skills used to organize an AFNR business (e.g., management types, organizational structures, time management techniques, conducting business agreements, etc.).
	2.1.3.2	Identify and interpret appropriate local, state, federal, international, and industry regulations that impact the management and operation of AFNR businesses.
	2.1.3.3	Identify and evaluate the presence or lack of ethical standards in planning and operating AFNR businesses.

Topic 2.2	<i>Use record keeping to accomplish AFNR business objectives, manage budgets, and comply with laws and regulations.</i>	
	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.).
Topic 2.4	<i>Develop a business plan for an AFNR business.</i>	
	Student Competencies	
	2.4.1	ANALYZE CHARACTERISTICS AND PLANNING REQUIREMENTS ASSOCIATED WITH DEVELOPING BUSINESS PLANS FOR DIFFERENT TYPES OF AFNR BUSINESSES.
	2.4.1.1	Describe the meaning, importance, and economic impact of entrepreneurship on the AFNR industry and larger economy.
	2.4.1.2	Categorize the characteristics of the types of ownership structures used in AFNR businesses (e.g., sole proprietorships, cooperatives, partnerships, and corporations).
	2.4.1.3	Research and describe the components to include in a business plan for an AFNR business.
	2.4.1.4	Classify the characteristics of successful entrepreneurs in AFNR businesses.
	2.4.2	DEVELOP PRODUCTION AND OPERATIONAL PLANS FOR AN AFNR BUSINESS.
	2.4.2.1	Identify and define the components of operational plans in AFNR businesses (e.g., location, supply and inventory management, production and distribution, organization structure, etc.).
	2.4.2.2	Devise strategies to illustrate the production process of an AFNR business to produce a specific agricultural product.
Topic 2.5	<i>Use sales and marketing principles to accomplish AFNR business objectives.</i>	
	Student Competencies	
	2.5.1	ANALYZE THE ROLE OF MARKETS, TRADE, COMPETITION AND PRICE IN RELATION TO AN AFNR BUSINESS SALES AND MARKETING PLANS.
	2.5.1.1	Distinguish and explain markets related to AFNR businesses (e.g. commodity markets, energy markets, etc.).

	2.5.1.2	Research and summarize different forms of market competition found in AFNR businesses (e.g., direct competitors, indirect competitors, replacement competitors, etc.).
	2.5.2	ASSESS AND APPLY SALES PRINCIPLES AND SKILLS TO ACCOMPLISH AFNR BUSINESS OBJECTIVES.
	2.5.2.1	Identify and explain components of the sales process for AFNR businesses (e.g., understanding needs, develop solutions, close sale, etc.).
	2.5.2.2	Research and summarize examples of different types of sales calls used in AFNR businesses (e.g., cold calls, face-to-face meetings, follow up calls, etc.).
	2.5.3	ASSESS MARKETING PRINCIPLES AND DEVELOP MARKETING PLANS TO ACCOMPLISH AFNR BUSINESS OBJECTIVES.
	2.5.3.1	Identify and explain marketing principles used in AFNR businesses (e.g., 4 P's [product, place, price, promotion]; attention, interest, desire, action, etc.).
	2.5.3.2	Research and categorize different strategies used in marketing programs for AFNR businesses (e.g., Internet, direct to customer, social media, etc.).
	2.5.3.3	Research and summarize the purpose, components and process to develop marketing plans for AFNR businesses.

Standard 4	BIOTECHNOLOGY SYSTEMS	
Topic 4.1	<i>Assess factors that have influenced the evolution of biotechnology in agriculture (e.g., historical events, societal trends, ethical, and legal implications, etc.).</i>	
	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.
	4.1.2	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).
Topic 4.2	<i>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.).</i>	
	Student Competencies	
	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.).
	4.2.3	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.
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.

Standard 8	PLANT SYSTEMS	
Topic 8.1	<i>Develop and implement a crop management plan for a given production goal that accounts for environmental factors.</i>	
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.).
	8.1.1.4	Analyze and describe plant responses to light color, intensity, and duration.
	8.1.1.5	Determine the optimal air and temperature conditions for plant growth.
	8.1.1.6	Analyze and describe plant responses to water conditions.
	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.
	8.1.2.3	Describe the physical and chemical characteristics of growing media and explain the influence they have on plant growth.
	8.1.2.4	Discuss how soil drainage and water-holding capacity can be improved.
	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.).
	8.1.3.7	Analyze the effects of nutrient deficiencies and symptoms and recognize environmental causes of nutrient deficiencies.
	8.1.3.8	Contrast pH and cation exchange capacity between mineral soil and soilless growing media.
	8.1.3.9	Interpret laboratory analyses of soil and tissue samples.
	8.1.3.10	Calculate the amount of fertilizer to be applied based on nutrient recommendation and fertilizer analysis.
Topic 8.2	<i>Apply principles of classification, plant anatomy, and plant physiology to plant production and management.</i>	
	Student Competencies	
	8.2.1	CLASSIFY PLANTS ACCORDING TO TAXONOMIC SYSTEMS.
	8.2.1.1	Identify and summarize systems used to classify plants based on specific characteristics.
	8.2.1.2	Describe the morphological characteristics used to identify agricultural and herbaceous plants (e.g., life cycles, growth habit, plant use and as monocotyledons or dicotyledons, woody, herbaceous, etc.).
	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.
	8.2.2.1	Identify structures in a typical plant cell and summarize the function of plant cell organelles.
	8.2.2.2	Identify and summarize the components, the types, and the functions of plant roots.
	8.2.2.3	Identify and summarize the components and the functions of plant stems.
	8.2.2.4	Research and summarize leaf morphology and the functions of leaves.
	8.2.2.5	Identify and summarize the components of a flower, the functions of a flower, and the functions of flower components.
	8.2.2.6	Identify and summarize the functions and components of seeds and fruit.
	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.
	8.2.3	APPLY KNOWLEDGE OF PLANT PHYSIOLOGY AND ENERGY CONVERSION TO PLANT SYSTEMS.
	8.2.3.1	Summarize the importance of photosynthesis to plant life on earth and the process of photosynthesis, including the types (c3, c4, Cam), its stages (e.g., light-dependent and light independent reactions), and its products and byproducts.
	8.2.3.2	Summarize the stages of cellular respiration including their products and byproducts.
	8.2.3.3	Summarize primary growth and the role of the apical meristem.
	8.2.3.4	Identify and categorize the five groups of naturally occurring plant hormones and synthetic plant growth regulators.
	8.2.3.5	Compare and contrast the effects of transpiration, translocation and assimilation on plants.
	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.
Topic 8.3	<i>Propagate, culture, and harvest plants and plant products based on current industry standards.</i>	
	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.
	8.3.2	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.
	8.3.2.5	Summarize the stages of plant growth and the reasons for controlling plant growth.
	8.3.2.6	Identify and categorize structures and technologies used for controlled atmosphere production of plants.
	8.3.2.7	Summarize the use of hydroponic and aquaponic systems for plant production.
	8.3.2.8	Inspect propagation material for evidence of pests or disease.
	8.3.2.9	Prepare soil and growing media for planting with the addition of amendments.
	8.3.2.10	Apply pre-plant treatments required of seeds and plants and evaluate the results.
	8.3.2.11	Monitor the progress of plantings and determine the need to adjust environmental conditions.
	8.3.2.12	Demonstrate proper techniques to control and manage plant growth through mechanical, cultural, or chemical means.
	8.3.2.13	Compare and contrast the types of technologies used for controlled atmosphere production.
	8.3.2.14	Compare and contrast the types of systems used in hydroponic and aquaponic plant production.
	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.
	8.3.3.5	Identify and analyze major local weeds, insect pests, and infectious and noninfectious plant diseases.
	8.3.3.6	Predict pest and disease problems based on environmental conditions and life cycles.
	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.
	8.3.4.3	Identify and summarize impacts of environmental conditions on plants.
	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.
	8.3.5.4	Identify and categorize plant preparation methods for storing and shipping plants and plant products.

	8.3.5.5	Summarize the reasons for preparing plants and plant products for distribution.
	8.3.5.6	Assess the stage of growth to determine crop maturity or marketability and demonstrate proper harvesting techniques.
	8.3.5.7	Evaluate crop yield and loss data and make recommendations to reduce crop loss.
Topic 8.4	<i>Apply principles of design in plant systems to enhance an environment (e.g. floral, forest landscape, and farm).</i>	
	Student Competencies	
	8.4.1	EVALUATING, IDENTIFYING, AND PREPARING PLANTS TO ENHANCE AN ENVIRONMENT.
	8.4.1.1	Identify and categorize plants by their purpose (e.g., floral plants, landscape plants, house plants, etc.).
	8.4.1.2	Summarize the applications of design in agriculture and ornamental plant systems.
	8.4.1.3	Demonstrate proper use of plants in their environment (e.g., focal and filler plants in floriculture, heat tolerant and shade plants in a landscape design, etc.).
	8.4.1.4	Create a design utilizing plants in their proper environments.
	8.4.2	CREATE DESIGNS USING PLANTS.
	8.4.2.1	Research and summarize the principles and elements of design for use in plant systems.
	8.4.2.2	Identify and categorize tools used for design (e.g., computer landscape software, drawing tools, florist tools, etc.).
	8.4.2.3	Explain the concept of landscape ecology and summarize factors that shape the ecology of a landscape (e.g., composition, structure, function, etc.).
	8.4.2.4	Apply principles and elements of design that form the basis of artistic impression.
	8.4.2.5	Demonstrate the use of tools used for creating designs.
	8.4.2.6	Research and provide examples of ecological factors incorporated into landscape designs.

Career Ready Practices (CRP)

FFA & SUPERVISED AGRICULTURAL EXPERIENCE

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.