BOTANY/HORTICULTURAL SCIENCE I

#01053

Description

These courses prepare students to produce greenhouse/nursery plants and to maintain plant growth and propagation structures. Topics 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 beautifying home grounds and other human habitation and recreation areas. 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 integral to 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.

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

Standard 1	*AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) FOUNDATIONAL PATHWAY SKILLS*	
Topic 1.6	**Identify and explain the implications of required regulations to maintain and improve safety, health, and environmental management systems.**	
	Student Competencies	
	1.6.2	Summarize the importance of safety, health, and environmental management in the workplace.
	1.6.3	Explain a health, safety, and environmental procedures to comply with regulatory and safety standards.
	1.6.5	Evaluate how AFNR organizations and businesses promote improved health, safety, and environmental management.
Topic 1.9	**Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.**	
	Student Competencies	
	1.9.1	Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.).
	1.9.2	Identify standard tools, equipment, and safety procedures related to AFNR tasks.
	1.9.3	Outline operating instructions related to operation, storage, and maintenance of tools and equipment related AFNR tasks.
	1.9.5	Demonstrate the set up and adjustment for tools and equipment related to AFNR tasks.
	1.9.6	Demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
	1.9.8	Choose appropriate tools and equipment to complete AFNR tasks.
Topic 1.13	**Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest.**	
	Student Competencies	
	1.13.2	Assess how personal skills and align them with potential career opportunities in AFNR pathways.
	1.13.3	Evaluate the results of a personal career assessment related to potential careers in AFNR pathways.
Topic 1.14	**Examine and explain foundational cycles and systems of AFNR.**	
	Student Competencies	
	1.14.1	Explain the life cycles in AFNR (e.g., water cycle, nutrient cycle, carbon cycle, reproductive, mechanical, etc.).
	1.14.3	Analyze how life cycles affect production, processing, and management of food, feed, fiber, and fuel.
	1.14.5	Interpret the impact of life cycles within AFNR systems.

Standard 2		***AGRIBUSINESS SYSTEMS***
Topic 2.1	**Apply economic principles to plan and manage inputs and outputs in an AFNR business.**	
	Student Competencies	
	2.1.1	Identify 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.).
	2.1.4	Apply microeconomic principles to calculate values associated with different inputs and outputs in AFNR businesses (e.g., price, point of equilibrium, opportunity costs, marginal costs, etc.).
Topic 2.3	**Develop and apply skills to manage an AFNR business in an efficient, legal, and ethical manner.**	
	Student Competencies	
	2.3.1	Identify examples of management skills used to organize an AFNR business (e.g., management types, organizational structures, time management techniques, conducting business agreements, etc.).
	2.3.7	Evaluate strategies to improve the operation of AFNR businesses using management skills.
Topic 2.5	**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.).**	
	Student Competencies	
	2.5.1	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.).
	2.5.2	Identify 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.).
	2.5.3	Evaluate the implementation and appropriateness of accounting systems and procedures used for record keeping in AFNR businesses.
	2.5.5	Recommend appropriate accounting systems to maintain records for AFNR businesses.
	2.5.6	Recommend tools and services to track, record, and audit AFNR business transactions that meet business needs and priorities (e.g., electronic and paper-based systems, etc.).
Topic 2.6	**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.).**	
	Student Competencies	
	2.6.1	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.
	2.6.2	Summarize strategies for tracking, reporting, and managing inventory in AFNR businesses (e.g., spreadsheets, databases, word processing, networked systems, and the Internet, etc.).
	2.6.4	Prepare financial reports to describe the performance of AFNR businesses (e.g., balance sheet, income statement, statement of cash flows, statement of equity, etc., etc.).

	2.6.5	Prepare financial reports associated with inventory in AFNR businesses (e.g., cost of goods sold, margins on goods, etc.).
	2.6.7	Interpret financial reports for AFNR businesses (e.g., evaluating efficiency, profitability, net worth, financial ratios, etc.).
Topic 2.7	**Manage cash budgets, assets, Employment Tax Incentive opportunities for credits, loans, etc. to achieve AFNR business goals.**	
	Student Competencies	
	2.7.1	Identify components of cash budgets (e.g., anticipated revenue, production costs, overhead costs, profit, etc.).
	2.7.2	Identify factors that impact management of cash budgets in AFNR businesses (e.g., changes in price of inputs/outputs, financial investment performance, capital purchases, human resources, etc.).
	2.7.3	Examine components of cash budgets (e.g., anticipated revenue, production costs, overhead costs, profit, etc.) to determine AFNR enterprise feasibility.
	2.7.5	Develop cash budgets for AFNR businesses.
	2.7.6	Predict the impact of management decisions on cash budgets in AFNR businesses.
Topic 2.10	**Develop production and operational plans for an AFNR business.**	
	Student Competencies	
	2.10.1	Define the components of operational plans in AFNR businesses (e.g., location, supply and inventory management, production and distribution, organization structure, etc.).
	2.10.2	Describe the production process of an AFNR business.
	2.10.3	Compare and contrast the strengths and weaknesses of operational plans from different AFNR businesses to determine best practices.
Topic 2.13	**Assess and apply sales principles and skills to accomplish AFNR business objectives.**	
	Student Competencies	
	2.13.1	Describe the components of the sales process for AFNR businesses (e.g., understand needs, develop solutions, close sales, etc.).
	2.13.3	Apply the sales process to accomplish the goals and objectives of an AFNR business.

Standard 6	*ENVIRONMENTAL SYSTEMS*	
Topic 6.2	**Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).**	
	Student Competencies	
	6.2.1	Identify basic laboratory equipment and explain their uses.
	6.2.3	Demonstrate the proper use and maintenance of basic laboratory equipment.
Topic 6.5	**Examine and summarize the impact of public perceptions and social movements on the regulation of environmental sustainability systems.**	
	Student Competencies	
	6.5.1	Summarize how the perception and regulation of environmental sustainability systems has changed over time.
	6.5.2	Examine how social changes (e.g., zero-waste philosophy, carbon footprints, recycling, etc.) have affected the implementation of new environmental sustainability systems.
	6.5.3	Analyze specific changes to perceptions and regulations of environmental sustainability systems and their impact on reducing the ecological, economical, and sociological impact.
	6.5.4	Assess the effectiveness of specific social changes related to regulation of environmental sustainability systems.
	6.5.5	Evaluate the impact of specific historical figures, or organizations, on the perception and regulation of environmental sustainability systems.
	6.5.6	Devise strategies for engaging the public to address a current AFNR issue brought on by social change.
Topic 6.7	**Apply soil science and hydrology principles to environmental sustainability systems.**	
	Student Competencies	
	6.7.3	Explain how the physical qualities of soil influence the infiltration and percolation of water.
	6.7.4	Define groundwater and its importance on environmental sustainability systems.
Topic 6.8	**Apply chemistry principles to environmental sustainability systems.**	
	Student Competencies	
	6.8.1	Explain how chemistry affects soil structure and function (e.g., pH, cation-exchange capacity, filtration capability, flooding likelihood, etc.).
	6.8.2	Explain how chemistry affects water quality and function (e.g., oxygen saturation, pH, biomagnification, etc.).
Topic 6.11	**Develop systems of sustainability management for all categories of solid waste in environmental sustainability systems.**	
	Student Competencies	
	6.11.1	Describe different types of pollution including point source and nonpoint source pollution.
	6.11.2	List ways in which pollution can be managed and prevented.
	6.11.3	Describe the conditions necessary for waste to be labeled as hazardous to the local environment

Standard 8	*NATURAL RESOURCES SYSTEMS*	
Topic 8.2	**Classify different types of natural resources in order to enable protection, conservation, enhancement, and management in a particular geographical region.**	
	Student Competencies	
	8.2.1	Define the characteristics used to identify trees and woody plants.
	8.2.2	Define the characteristics used to identify herbaceous plants.
	8.2.7	Apply identification techniques to determine the species of a tree or woody plant.
	8.2.8	Apply identification techniques to determine the species of an herbaceous plant.

Standard 9	*PLANT SYSTEMS*	
Topic 9.1	**Determine the influence of environmental factors on plant growth.**	
	Student Competencies	
	9.1.2	Identify the effects of environmental conditions (e.g., air movement, temperature, humidity, etc.) on plant growth.
	9.1.3	Describe the effects of water quality on plant growth, (e.g., pH, dissolved solids, etc.).
	9.1.4	Analyze plant responses to light color, intensity, and duration.
	9.1.5	Determine the optimal environmental conditions for plant growth.
Topic 9.2	**Prepare and adjust growing media for use in plant systems.**	
	Student Competencies	
	9.2.1	Describe the major forms of growing media (e.g., hydroponics, soil, greenhouse potting mix, rockwool, etc.).
	9.2.2	Identify the physical characteristics of soil water (e.g., water holding capacity, plant available water, permanent wilting point, gravitational water, etc.) and soil texture (e.g., sand, silt, clay, etc.).
	9.2.3	Describe the physical and chemical characteristics of growing media and explain the influence they have on plant growth.
	9.2.4	Discuss how differences in growing media can affect drainage (e.g., drain tile, surface drainage, tillage, porosity, irrigation, etc.).
Topic 9.3	**Demonstrate planting techniques and create the conditions needed for seed germination.**	
	Student Competencies	
	9.3.1	Describe the steps to growing crops including crop selection, land preparation, seed selection, seed sowing, irrigation, fertilizing, and harvesting.
Topic 9.4	**Develop and implement a nutrient management and/or fertilizer plan for specific plants or crops.**	
	Student Competencies	
	9.4.1	Explain the role of macronutrients and micronutrients for plant growth and development and their major functions (e.g., nitrogen, phosphorus, potassium, iron, sulfur, etc.).
	9.4.2	Explain the influence of electric conductivity (EC, soluble salts), pH, and cation exchange capacity on the availability of plant nutrients and crop growth.
	9.4.6	Identify nutrient deficiencies in plants.
	9.4.12	Recommend a plan of action to adjust the electric conductivity (EC, soluble salts) and pH of growing media given soil tests for specific plants or crops.
	9.4.14	Recommend a fertilizer application method (e.g., liquid, dry, variable rate, manure, etc.).
Topic 9.5	**Classify plants according to taxonomic systems.**	
	Student Competencies	
	9.5.1	Identify plants based on visual characteristics (e.g., seedling stages, fully grown, etc.).
	9.5.2	Classify the morphological characteristics and systems used to identify agricultural and herbaceous plants (e.g., life cycles, growth habit, plant use and as monocotyledons, or dicotyledons, woody, herbaceous, etc.) by common and scientific names.

	9.5.3	Assess the importance of plants to agricultural and ornamental plant systems by scientific names.
Topic 9.6	**Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.**	
	Student Competencies	
	9.6.1	Identify structures in a typical plant cell and explain the function of plant cell organelles.
	9.6.2	Identify the components, the types, and the functions of plant roots.
	9.6.3	Identify the components and the functions of plant stems.
	9.6.4	Identify morphological features found in leaves, how they contribute to plant identification, and how they relate to overall plant growth.
	9.6.5	Describe the components of a flower, the functions of a flower, and the functions of flower components.
	9.6.6	Identify the functions and components of seeds and fruits.
	9.6.7	Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems.
	9.6.8	Analyze root tissues and explain the pathway of water and nutrients into and through root tissues.
	9.6.9	Contrast the difference in arrangement of vascular tissue between monocot and dicot plant stems.
	9.6.10	Analyze how leaves capture light energy and exchange gasses.
	9.6.11	Differentiate between the types of flowers and flower inflorescence (e.g., complete, incomplete, perfect, imperfect).
	9.6.12	Categorize the major types of seeds and fruits.
	9.6.15	Evaluate the function of the xylem, phloem, and cambium tissues and their impact on plant systems.
Topic 9.7	**Apply knowledge of plant physiology and energy conversion to plant systems.**	
	Student Competencies	
	9.7.1	Describe the photosynthesis pathway and its reactants and products.
	9.7.3	Explain primary growth and the role of the apical meristem.
	9.7.9	Analyze the plant responses to plant growth regulators and different forms of tropism.
Topic 9.8	**Demonstrate plant propagation techniques in plant system activities.**	
	Student Competencies	
	9.8.1	Describe pollination, cross-pollination, and self-pollination of flowering plants.
	9.8.2	Identify sowing techniques used to create favorable conditions for seed germination.
	9.8.3	Summarize optimal conditions for asexual propagation.
	9.8.4	Explain the main stages of micropropagation.
	9.8.5	Explain the principles of recombinant DNA technology and the basic steps in the process.
	9.8.7	Examine factors that affect seed viability, vigor, and germination rates.
	9.8.8	Demonstrate plant propagation techniques (e.g., cuttings, division, separation, layering, budding and grafting, etc.).
	9.8.12	Conduct tests associated with seed germination rates, viability, and vigor.
Topic 9.9	**Develop and implement a management plan for plant production.**	
	Student Competencies	
	9.9.1	Explain the importance of starting with pest- and disease-free propagation material.
	9.9.2	Explain the reasons for preparing growing media before planting.
	9.9.3	Determine seeding rate needed for specified plant populations or desired quantity of finished plants.

	9.9.4	Describe environmental conditions during the germination, growth, and development of a crop.
	9.9.5	Explain the stages of plant growth and the methods and reasons for controlling plant growth.
	9.9.7	Describe the use of hydroponic and aquaponic systems for plant production.
	9.9.8	Inspect propagation material for evidence of pests or disease.
	9.9.9	Prepare soil and growing media for planting with the addition of amendments.
	9.9.11	Adjust environmental conditions based on the progress of plantings.
	9.9.18	Prepare a plant production schedule based on predicted environmental conditions and desired market target (e.g., having plants ready to market on a specific day such as Mother's Day, organic production, low maintenance landscape plants, etc.).
	9.9.19	Prepare plant production schedules utilizing plant growth knowledge to get plants to their optimal growth stage at a given time.
Topic 9.10	**Develop and implement a plan for integrated pest management for plant production.**	
	Student Competencies	
	9.10.6	Predict pest and disease problems based on environmental conditions and life cycles.
Topic 9.14	**Evaluate, identify, and prepare plants to enhance an environment.**	
	Student Competencies	
	9.14.1	Identify plants by their purpose (e.g., floral plants, landscape plants, house plants, etc.).
	9.14.2	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.).
	9.14.3	Create a design plan by selecting plants based on design elements and environmental conditions.
Topic 9.15	**Create designs using plants.**	
	Student Competencies	
	9.15.1	Explain the applications of design in agriculture and ornamental plant systems.
	9.15.2	Classify tools used for design (e.g., computer landscape software, drawing tools, florist tools, turf management, etc.).
	9.15.7	Propose suggestions for improvement of a design (e.g., a floral arrangement, a landscape or a landscape plan, turfgrass management, etc.).
	9.15.8	Recommend appropriate tools to create a desired design.