Greenhouse and Nursery Management
Subject Code: 010610
Course & Unit Descriptions

Course Description:
Students will learn production practices for the successful growth of nursery stock and/or greenhouse plants. The course will infuse principles science, engineering, and business to address sustainable production and greenhouse facility management. Environmental operations including water and fertilizer distribution, lighting, ventilation, temperature, and pest control will be applied. Students will demonstrate knowledge of propagation methods, plant health, nutrition, and growth stimulation. Students will also engage in communication, marketing, sales, and service related to the greenhouse and nursery industries.

Unit: Safety
Students will demonstrate their knowledge of safety rules and regulations throughout the course along with identifying any safety signs and signals. Students will describe health and safety practices plus demonstrate appropriate responses for major types of hazardous materials disasters. Students will analyze factors that can influence environmental conditions and identify those responses to emotional, physiological and environmental stress. Students will identify and implement various emergency response plans

Benchmark: 4.1 Safety Procedures
Level 2: Follow safety procedures in specific situations with specialized tools and equipment, evaluate situation and take corrective action

Indicators
4.1.01 Demonstrate knowledge of safety rules and regulations
4.1.02 Interpret safety signs and symbols
4.1.03 Model safe attitudes and behaviors (e.g., lifting, climbing)
4.1.04 Identify safety hazards and take corrective measures
4.1.05 Use safety equipment in accordance with established procedures
4.1.06 Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary

Academic Standards
English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

Unit: Electrical
Student will explain the color-coding of electrical connections and determine the kind, size, number and location of wiring system components. Students will be able to install and service low-voltage systems.

Benchmark: 4.14 Electrical
Level 2: Develop a schematic that illustrates the kind, number and location of outlets and switches in a wiring system and install the design

Indicators

4.14.01 Describe the theory of producing electricity (relationship between amperes, volts and watts; ohms law)
4.14.04 Calculate service requirements for electrical systems
4.14.05 Describe distribution system components
4.14.06 Determine the type of branch circuits needed in a wiring system
4.14.07 Determine the kind, size, number and location of wiring system components (e.g., outlets, switches, lights, wire, circuit breakers, motors, etc.)
4.14.09 Explain the color-coding of electrical connections
4.14.10 Install and identify over-current protective devices
4.14.11 Install and service low-voltage systems (e.g., control systems and lighting systems)

Academic Standards

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

Science: Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance. (Physical Sciences C, 9-10)

Unit: Water and Soil

Students will understand and implement practices to maintain or improve water quality. Students will also understand the qualities of soil and their implications in greenhouse production.

Benchmark: 5.1 Soils

Level 2: Utilize knowledge of soil characteristics and soil information resources to overcome any existing soil use limitations

Indicators

5.1.01 Classify soil types based on composition (e.g., aggregate size, organic matter, texture)
5.1.07 Identify soil forming factors and explain how they produce variability in soils

Academic Standards

English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

Math: Describe and interpret rates of change from graphical and numerical data. (Algebra J, 8-10)

Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Social Studies: Use appropriate data sources and geographic tools to analyze and evaluate public policies. (Geography C, 11-12)

Benchmark: 5.2 Water

Level 2: Analyze and interpret the biological, chemical and physical properties of water quality

Indicators

5.2.03 Explain the hydrological cycle (e.g., condensation, evaporation, transpiration) and how human activity impacts the cycle
5.2.04 Explain the biotic and abiotic factors affecting water quality
5.2.05 Monitor and analyze water quality and quantity
5.2.07 Implement practices to maintain or improve water quality

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Unit: Plant Nutrients and Composting

Students will study organic and inorganic sources of macronutrients and micronutrients plus describe their functions. Students will identify the symptoms and causes of plant nutrient deficiencies and then analyze the data collected from plant tissue and soil to draw conclusions for optimum management. Students will collect, analyze, and treat waste materials along with identifying the risks associated with solid waste accumulation, utilization and disposal. Students will describe the process of aerobic and anaerobic waste decomposition along with monitoring solid waste disposal procedures.

Benchmark: 5.10 Solid Waste and Renewable Resource Management
Level 2: Control and process solid waste using available and alternative technology

Indicators
5.10.01 Collect, analyze, and treat waste materials (e.g., mortalities, manure, garbage)
5.10.02 Identify the risks associated with solid waste accumulation, utilization and disposal
5.10.03 Determine acceptable site for disposal of solid waste
5.10.04 Describe the process of aerobic and anaerobic waste decomposition (biotic and abiotic influences)
5.10.05 Describe and monitor solid waste disposal procedures (e.g., landfills, lagoon, run-off)
5.10.06 Describe and implement waste management methods (e.g., composting facility, waste incineration, recycling)
5.10.07 Explain control processes and potential use for waste byproducts (e.g., landfill gas, sludge, manure, methane)
5.10.08 Describe standard operational techniques and identify design requirements for specific purposes (e.g., landfill, lagoon, leachate treatment)
5.10.09 Describe site closure methods and post-closure monitoring
5.10.10 Determine solid waste volume generated by an operation or facility

Academic Standards
English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Unit: 7.1 Plant Nutrition
Level 2: Diagnose macronutrient and common micronutrient deficiencies in specific plants and select and apply macronutrients and micronutrients, using specialized application methods

Indicators
7.1.01 Compare and contrast organic and inorganic sources of macronutrients and micronutrients
7.1.02 Describe the functions of macronutrients and micronutrients
7.1.03 Determine nutrient requirements for food-grade, non-food-grade and organic plants
7.1.04 Identify symptoms and causes of plant nutrient deficiencies
7.1.05 Collect and test soil and/or plant tissue
7.1.06 Analyze test data from soil and plant tissue, make inferences and draw conclusions for optimum management
7.1.07 Determine the biotic and abiotic factors that influence and optimize availability of nutrients to plants (e.g., pH, microorganisms, growth media)

7.1.08 Calculate nutrient requirements and select nutrient sources and additives for optimum economic return
7.1.09 Select application methods, determine time of application, and apply nutrients
7.1.10 Interpret fertilizer labels

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)

Benchmark: 7.2 Plant Reproduction

Level 2: Select and apply specialized methods for propagating plants

Indicators

7.2.01 Identify reproductive anatomy of plants and describe their physiological functions
7.2.02 Determine the biotic and abiotic factors that influence and optimize plant reproduction (e.g., insects, light, temperature, microorganisms, moisture, location)
7.2.03 Select seeds/seed stock for desired traits (e.g., color, drought resistance, chemical resistance, environmental impact)
7.2.04 Select and use methods to create desired traits in seeds and fruits (e.g., detasseling, mechanical pollination)
7.2.05 Select and use methods of asexual plant propagation for desired traits (e.g., grafting, layering, cuttings, cloning)
7.2.06 Compare and contrast variations of plant reproductive systems among plant species and their adaptive and non-adaptive values

Academic Standards

English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)

Unit: Pest Management and Bio-Security

Students will identify and classify plant pests and examine their interrelationships between plant, humans, and the environment. Students will determine and implement pest management safety practices. Students will recognize the sources and origins of agents that can contaminate processed and unprocessed food products. Students will identify the activities and agents that contribute to the risk of acquiring or preventing a specific disease along with identifying the sources of tampering points.

Benchmark: 3.12 Agrosecurity and Biosecurity

Level 2: Implement a security plan addressing facility needs and tampering points

Indicators

3.12.01 Recognize sources and origins of agents that can contaminate processed and unprocessed food products
3.12.02 Identify activities and biological agents that contribute to the risk of acquiring or preventing a specific disease
3.12.03 Identify sources of biological and chemical tampering points
3.12.04 Assess facility security, classify level of risk and recommend improvements
3.12.07 Screen and test animals and plant products for infectious agents or contamination
3.12.08 Use biocontainment practices (e.g., quarantine, eradicate) to manage pests and disease vectors

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Benchmark: 7.3 Pest Management

Level 2: Scout and identify specific plant pests and plant damage and apply specialized pest management control methods

Indicators

7.3.01 Identify and classify plant pests (i.e., insects, pathogens, weeds, diseases, animals)
7.3.03 Analyze and calculate economic threshold of pest damage
7.3.04 Determine and implement pest management safety practices (e.g., MSDS, EPA, OSHA, PPE)
7.3.05 Develop an integrated pest management plans based on pest life cycles, available treatments and application methods
7.3.06 Select application methods, implement pest control plan (i.e. organic and non-organic) and evaluate effectiveness and impact on environment

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data. (Data Analysis D, 8-10)
Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)
Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

Unit: Sales and Customer Service/Purchasing and Inventory

Students will identify the key components to organizing a sale, developing goals and creating incentive programs. Students will discuss and evaluate the appropriateness of different sales techniques along with building and developing customer relationships. Students will select target markets and consumers along with researching products, service designs, and also determine the feasibility of new products. Students will identify the different channels of distribution and methods of marketing products and services. Students will explain the nature and scope of bidding out purchasing to different vendors. Students will use the technology available to handle product inventory.

Benchmark: 3.2 Sales and Customer Service

Level 2: Use sales techniques to close the sale of a product/service and handle complex customer issues

Indicators

3.2.01 Identify key components to organize a sale
3.2.02 Develop sales goals and incentive programs
3.2.03 Forecast sales and delivery times
3.2.04 Prospect for new customers
3.2.05 Discuss and evaluate the appropriateness of different sales techniques/approaches in specific situations
3.2.06 Develop and conduct sales presentation
3.2.07 Utilize suggestive selling and selling up techniques
3.2.08 Build and develop customer relationships
3.2.09 Apply appropriate questioning techniques to determine client needs and wants

3.2.10 Provide product, warranty and maintenance education to the customer
3.2.11 Complete sales transactions and close-out procedures (e.g., handle money, operate cash register, scan bar codes, record sales, write invoices/orders)
3.2.12 Utilize follow-up activities/strategies and provide post-sale service
3.2.13 Handle customer complaints

Academic Standards

English: Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

Benchmark: 3.5 Purchasing and Inventory

Level 2: Manage inventory based on budgeting and sales forecasting

Indicators

3.5.01 Explain the nature and scope of purchasing
3.5.02 Manage the bid process in purchasing
3.5.03 Evaluate and select vendors
3.5.04 Discuss types of inventory and evaluate inventory control systems (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just-In-Time [JIT])
3.5.05 Record inventory usage
3.5.06 Calculate costs of carrying and not carrying inventory

Academic Standards

English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

Math: Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions. (Measurement F, 8-10)

Unit: Management

Students will evaluate management styles and explain the characteristics of business plans. Students will develop business goals, objectives, and mission statements. Students will document their business activities and track the performance of their business plan.

Benchmark: 3.3 Management

Level 2: Analyze performance of an enterprise and reallocate resources to achieve goals

Indicators

3.3.01 Evaluate management styles
3.3.02 Explain the characteristics of business plans
3.3.03 Develop business goals/objectives and mission statement
3.3.04 Identify organizational structures of businesses
3.3.05 Plan operational capacity
3.3.06 Develop a continuous-improvement management program
3.3.07 Establish business relationships
3.3.08 Document business activities
3.3.09 Track performance of business plan
3.3.10 Assess the profitability of a product
3.3.11 Analyze operating results in relation to budget/industry
3.3.12 Perform human-resource management functions (e.g., recruit, select, evaluate, terminate employees)
3.3.13 Identify crisis management techniques

Academic Standards

English: Analyze the features and structures of documents and critique them for their effectiveness. (Reading: Informational Text A, 11-12)

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

Social Studies: Identify factors which inhibit or spur economic growth and cause expansions or recessions. (Economics B, 11-12)

Unit: Communication

Students will apply techniques to participate in or facilitate a group discussion along with applying active listening strategies. Students will develop and deliver formal and informal presentations and communicate directions in an organized manner appropriate to the targeted audience. Students will utilize technology to maintain and monitor business records along with conducting research using the internet. Students will create and utilize documents using word processors, spreadsheets, databases, and electronic mail.

Benchmark: 3.7 Communication Skills

Level 2: Conduct a business meeting using decision-making techniques

Indicators

3.7.01 Apply techniques to participate in/facilitate a group discussion
3.7.02 Apply active listening strategies
3.7.03 Develop and deliver formal and informal presentations
3.7.04 Articulate ideas and impact audience through verbal and nonverbal communication
3.7.05 Communicate directions in an organized manner appropriate to the audience
3.7.06 Use consensus-building techniques, including parliamentary procedure, to make decisions and compile summary of meeting minutes, conclusions, and next steps
3.7.07 Extract relevant, valid information from materials and cite sources of information
3.7.08 Develop reports and documents that organize information accurately and use formatting techniques for user friendliness
3.7.09 Select and use appropriate channel for workplace communication
3.7.10 Practice etiquette when using communication techniques

Academic Standards

English: Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

Social Studies: Evaluate the reliability and credibility of sources. (Social Studies Skills and Methods A, 9 -10)

Unit: Work Place Skills

Students will conduct interpersonal and intrapersonal inventories and identify how individual actions impact others. Students will learn how to manage personal emotions, behavior and appearance to maintain professionalism. Students will identify the purpose, ethical dimensions and the relationship between leaders and team members. Students will think critically and use problem solving skills to analyze complex and diverse concepts.

Benchmark: 3.8 Business Leadership

Level 2: Use multiple leadership concepts to change situations and enhance effectiveness in the change process

Indicators

3.8.01 Identify the purpose of leadership, the ethical dimensions of leadership and the relationship between leaders and team members
3.8.02 Identify leadership styles and traits of leaders
3.8.03 Identify the impact of individual differences and different situations on the practice of leadership
3.8.04 Assess strengths and weaknesses of leaders and team members and employ team-building techniques
3.8.05 Participate in and lead a small group with an interdependent task
3.8.08 Manage time with organizational tools and prioritize objectives, responsibilities and tasks
3.8.09 Apply conflict-resolution skills
3.8.11 Develop relationships with peer groups, support services, and professional organizations

Academic Standards

English: Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)
Math: Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)
Social Studies: Critique data and information to determine the adequacy of support for conclusions. (Social Studies Skills and Methods B, 11-12)

Benchmark: 3.9 Emotional Intelligence

Level 2: Exhibit techniques to control emotional reactions to people and situations

Indicators

3.9.01 Conduct an interpersonal and intrapersonal inventory
3.9.02 Identify how individual actions impact others
3.9.03 Manage personal emotions, behavior and appearance to maintain professionalism
3.9.04 Describe and exhibit appropriate ethical behavior
3.9.05 Accept and use constructive feedback to improve work habits
3.9.06 Employ appropriate coping skills to prevent/handle workplace conflicts
3.9.07 Recognize, respect and utilize the diversity among people and cultures
3.9.08 Foster positive working relationships

Academic Standards

English: Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)
Social Studies: Analyze how issues may be viewed differently by various cultural groups. (People in Societies A, 11-12)

Unit: Plant Production and Harvesting

Students will identify and classify seeds and plants at all stages of growth along with their anatomical structures and tissues. Students will identify and classify plants using taxonomy and evaluate and demonstrate planting and transplanting practices. Students will determine crop maturity and identify safe harvesting, handling and storage practices. Students will prepare products for sale, transportation, and storage.

Benchmark: 7.4 Plant Production and Management

Level 2: Manage growth of specific types of plants using specialized equipment

Indicators

7.4.01 Identify and classify seeds and plants at all stages of growth
7.4.02 Identify plant anatomical structures and tissues (e.g., roots, stems, flowers, leaves, fruits, seeds)

7.4.03 Describe physiological functions of plants (e.g., photosynthesis, respiration, transpiration, absorption)
7.4.04 Identify and classify plants using taxonomy
7.4.05 Select seeds and plants (e.g., production, ornamental, erosion control, genetically modified organism [GMO], moisture control, bioremediation)
7.4.06 Manipulate abiotic and biotic factors (e.g., irrigation, mulch, lighting, temperature, drainage) to alter plant germination, growth and development
7.4.07 Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments, cuttings and pot in pot, type of planter)
7.4.08 Evaluate and implement transplanting practices
7.4.09 Evaluate/select and prepare soil/media for planting
7.4.10 Control plant growth (e.g., pruning, pinching, chemical, disbudding)
7.4.11 Determine maintenance schedule for plant management plan
7.4.12 Analyze and satisfy plant water requirements
7.4.13 Identify characteristics (e.g., visual appeal, quality, test weights, final usage) of grains, seeds, vegetables, fruits, and ornamental plants

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological). (Life Sciences D, 9-10)

Benchmark: 7.5 Harvesting, Handling and Storage

Level 2: Identify and minimize harvest loss and select preferred harvesting, handling and storage method

Indicators

7.5.01 Determine crop maturity
7.5.02 Identify safe harvesting, handling and storage practices
7.5.03 Determine and control environmental conditions relative to harvesting, handling and storage
7.5.04 Demonstrate harvesting, handling and storage techniques to minimize loss and maximize economic return
7.5.05 Calculate yield and loss of harvesting, processing and storage
7.5.6 Maintain and/or enhance quality of plant products in harvesting, handling and storage (e.g., temperature, humidity, retardants, light, chemicals, contamination)
7.5.7 Prepare products for sale, transportation and storage

Academic Standards

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)