2005 Mississippi Curriculum Framework

Secondary Horticulture

(Program CIP: 01.0601 – Applied Horticulture/Horticultural Operations, General)

Direct inquiries to

Program Coordinator
Agriculture Education
Office of Vocational and Technical Education
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
(601) 359-3940

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Acknowledgments

Writing Team: Rusty Coats, Millsaps Career and Technology Center
Patricia Heath, Northeast Lauderdale High School
Paul Lee, Grenada Career and Technology Center
Charles Norwood, North Panola Career and Technology Center
Rickey Red, South Panola High School

RCU Staff: Jimmy McCully, Ph.D. – Coordinator, Agriculture and Special Initiatives

MDE Staff: Bill McGrew, Agriculture Education Program Coordinator

Professional Curriculum Advisory Team: Don Tartt, Grenada, Mississippi
Doyle Williams, Mid-America Wholesale Florists
Brenda Deloach, Carrol-Black Florist
Jody Ogletree, Standing Pines Nursery
Martha Hill, Hinds Community College
Gail Barton, Meridian Community College

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Proposed Standards for Mississippi Agriculture Education Programs Adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*, National Association of State Directors of Career and Technical Education. The Career Clusters content used herein are copyrighted, proprietary information of the National Association of State Directors of Career Technical Education Consortium, States' Career Clusters Initiative. Referenced with permission.

Academic Standards Mississippi Department of Education Subject Area Testing Program

Workplace Skills for the 21st Century Secretary's Commission on Achieving Necessary Skills

ISTE National Educational Technology Standards for Students

Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
  - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
  - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the general workplace skills as identified in the Secretary's Commission on Achieving Necessary Skills (SCANS) report as being critical for all workers in the 21st Century. In addition, national technology standards and occupational skills standards associated with the competencies and suggested objectives for the unit are also identified.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Program Description

The secondary program in Horticulture prepares individuals for entry level employment or continuing education in a wide variety of fields in the horticulture industry. Students enrolled in the program participate in a variety of instructional activities including lectures, discussions, laboratory experiences at the school, and work-based learning activities in the field such as field trips and shadowing experiences. Students also receive supplementary instruction and reinforcement of learning through activities in youth organizations. Topics covered in the two-year program include plant structure and growth; plant propagation; pest management; floristry; greenhouse crops and management; olericulture; plantscaping; landscape design, installation, and management; and turfgrass management. Student competencies and suggested objectives in the curriculum framework have been correlated to the knowledge and skill statements listed in *Career Cluster Resources for Agriculture, Food, and Natural Resources*, as published by the National Association of State Directors of Career and Technical Education.

Course Outline

Horticulture I

Course CIP Code: 01.0601

Unit	Title	Hours
Unit 1:	Horticulture Orientation and Leadership Development	10.5
Unit 2:	Plant Structure and Growth	25.5
Unit 3:	Plant Classification and Identification (Taxonomy)	10.5
Unit 4:	Plant Growth Media and Nutrition	25.5
Unit 5:	Horticulture Structures	10.5
Unit 6:	Basic Plant Propagation	30.0
Unit 7:	Principles of Pest Management	22.5
Unit 8:	Basic Principles of Floristry	22.5
Unit 9:	Greenhouse Crops	22.5
Unit 10:	Olericulture Production	18.0

Horticulture II

Course CIP Code: 01.0690

Unit	Title	Hours
Unit 1:	Leadership, Careers, and Safety	18.0
Unit 2:	Nursery and Landscape Plant Identification	25.5
Unit 3:	Advanced Plant Propagation	7.5
Unit 4:	Horticulture Marketing and Business Procedures	7.5
Unit 5:	Container and Field Crop Production	7.5
Unit 6:	Floriculture Crop Production	15.0
Unit 7:	Landscape Design	30.0
Unit 8:	Landscape Installation and Construction	22.5
Unit 9:	Landscape Maintenance	15.0
Unit 10:	Turfgrass Installation and Maintenance	15.0
Unit 11:	Pomology Production	7.5
Unit 12:	Advanced Floral Design	15.0

Horticulture I
Unit 1: Horticulture Orientation and Leadership Development (10.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify school and program policies and procedures related to the horticulture program. a. Describe school policies related to the horticulture program. b. Identify and describe policies specific to the horticulture program, including policies and procedures associated with supervised experience.	**Teaching:** • Have students read the local school handbook. Discuss school policies and procedures as identified in the local school handbook. E2, E3, E4 • Provide students with a written copy of policies and rules associated with the horticulture program. Describe and discuss these policies and rules with the students. E2, E3, E4, E9 **Assessment:** • Student sign-off sheet acknowledging discussion of school and program policies.
2. Demonstrate basic and fundamental safety practices related to horticulture enterprises. a. Identify hazards that may be found in horticulture operations and activities such as poisons and other chemicals, sunburn, ladders and scaffolds, electrical shock, fire, poisonous insects and snakes, equipment and tool hazards, spills and slipping, etc. b. Identify and demonstrate the use of personal protection devices including eye protection, hearing protection, foot protection, respiratory protection, clothing, and body protection, etc. c. Identify and describe the use of general safety equipment in horticulture operations including fire extinguishers, eyewash and shower stations, first-aid kits, etc. d. Identify and apply general safety rules that apply to the horticulture classroom and laboratory.	**Teaching:** • Take students on a tour of the horticulture laboratory and point out hazards and hazardous materials present. Discuss the use of colors and signal words for recognizing hazards. Stress that awareness of hazards is a key element in the prevention of accidents and injuries. • Identify and demonstrate/discuss the use of personal protection equipment and when the use of such equipment is necessary. • Show videos on safety equipment and procedures. • Provide students with a written copy of general safety rules; have them read and then discuss these rules as applied to the local horticulture department. E2, E3, E4, E9 **Assessment:** • Teacher observation of student participation in discussions and activities. • Teacher-constructed test on hazards, safety equipment, and safety rules.
3. Identify and describe the role of organizations that encourage leadership development. a. Identify and describe the role of student youth organizations that encourage leadership development.	**Teaching:** • Have officers of the FFA chapter talk to the class concerning the role of FFA in developing leadership skills through specific career development events and recognition programs.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
b. Identify and describe the role of trade organizations in horticulture that encourage leadership development.	• Invite a representative of a horticulture organization or government agency (Mississippi Nurseryman/Landscape Association, area extension horticulture specialist) to speak to the class on the role of trade organizations. **Assessment:** • Teacher-constructed test on student leadership development and organizations.
4. Participate in leadership development activities. a. Identify and describe basic terms and principles associated with leadership. b. Identify and describe basic principles of teamwork and cooperation in small groups. c. Lead a small group in accomplishing a given task. (on-going throughout the year)	**Teaching:** • Teacher-led discussion of basic terms and principles associated with leadership. E2, E9 • Teacher-led discussion of basic principles of teamwork and cooperation. E2, E9 • As the course progresses, each student will be assigned to lead a small group in accomplishing a given task. E4 **Assessment:** • Teacher evaluation of student using a checklist or rubric in leading a small group. • Teacher-constructed test on basic terms and principles of leadership and teamwork.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 1 Know and understand the importance of professional ethics and legal responsibilities.
ELR 2 Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.

Academic Standards

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Kimbrell, B., & Chambers, D. (2002). *Developing safety skills for the shop and home.* Winterville, GA: American Association for Vocational Instructional Materials.

National FFA Organization. (2004). Lifeknowledge [Computer software]. Indianapolis, IN: Author.

National FFA Organization. (2004). *Advisors handbook*. Indianapolis, IN: Author.

National FFA Organization. (2004). *Student handbook*. Indianapolis, IN: Author.

National Ag Safety Database. Retrieved October 11, 2004, from http://www.cdc.gov/nasd/menu/topic/topic.html

Horticulture I
Unit 2: Plant Structure and Growth **(25.5 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify parts of a plant and their functions. a. Identify the primary parts of a plant and describe the function of each part including roots, stems, leaves, and flowers. b. Identify the various types of each primary part, and discuss the differences in each type.	**Teaching:** • Have students read Unit 3 in Reiley and Shry and complete the self-evaluation activity. B2, B3, E2, E3, E4 • Have students bring a plant specimen to class and complete an activity to identify the different parts of the plant. B2, B3, E3, E4 **Assessment:** • Evaluation of self-evaluation activity. • Evaluation of student activity to identify different parts of a plant using a checklist. • Teacher-constructed test on parts of a plant and their functions.
2. Describe the growth process in plants. a. Describe processes by which plants grow including photosynthesis, respiration, transpiration, and translocation. b. Describe the relationship of environmental and cultural factors to plant growth (water, light, temperature, soil, climatic zones, etc.).	**Teaching:** • Have students read Unit 4 in Reiley and Shry and complete the self-evaluation activity. B2, B3, B4, E2, E3, E4 • Describe and discuss, with presentation media, the processes by which plants grow. Have students create a drawing to trace the movement of water and nutrients from the roots to the leaves. B2, B3, B4, E3, E4 • Use an integration project with the biology teacher to reinforce instruction in growth processes. • Describe and discuss, with presentation media, the environmental and cultural factors that influence plant growth. B2, B3, B4, E3, E4 **Assessment:** • Evaluation of self-evaluation. • Teacher-constructed test on growth processes and environmental and cultural factors.

STANDARDS

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PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
NRS 1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.

Academic Standards

B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Pearson Prentice Hall.

Jacks, L. P. (n.d.). *Basic principles of plant science*. Mississippi State , MS: Research and Curriculum Unit.

Jacks, L. P., & Hamilton, J. R. (1977). *Basic principles of soil science.* Mississippi State, MS: Research and Curriculum Unit.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture I
Unit 3: Plant Classification and Identification (Taxonomy) (10.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Apply systems of plant classification. a. Compare the different systems of plant classification according to life cycle (annual, biennial, and perennial); leaf cycle (evergreen and deciduous); and seed leaf number (monocot and dicot). b. Describe the use of the binomial system in classifying plants including common and scientific names. c. Demonstrate the use of the binomial system.	**Teaching:** • Have students read Unit 2 in Reiley and Shry ("Plant Taxonomy: How Plants are Named") and complete the self-evaluation at the end of the unit. Use a PowerPoint or overhead transparency presentation to define terms, systems, cycles, and seed leaf number. B3, E1, E2, E3, E4 • Describe the use of binomial nomenclature and scientific names in classifying plants to the students. B1 • Have students make a leaf collection and classify the plants in that collection by scientific and common names. B1, B7, E3, E4 **Assessment:** • Assessment of self-evaluation from textbook. • Teacher-evaluation of leaf collection based on a checklist. • Teacher developed test on plant classification and identification.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.

Academic Standards

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B3 Investigate cell structures, functions, and methods of reproduction.
B7 Investigate the interdependence and interactions that occur within an ecosystem.

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Bridwell, F. M. (2003). *Landscape plants: Their identification, culture, and use.* Albany, NY: Delmar.

National FFA Organization. (2004). *Nursery and landscape CDE plant list*. Retrieved October 10, 2004, from www.ffa.org/ageducators/documents/lpsguide/programs/cde/cde_handbook04.pdf

National FFA Organization. (2004). *National floriculture CDE plant list*. Retrieved October 10, 2004, from www.ffa.org/ageducators/documents/lpsguide/programs/cde/cde_handbook04.pdf

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture I
Unit 4: Plant Growth Media and Nutrition (25.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of plant growth media. a. Identify and compare the components of natural soil, and describe the characteristics each one imparts to the root medium. b. Describe the characteristics of an ideal growing medium. c. Differentiate between a soil and a soilless root medium, and list the common components of a soilless root medium and the characteristics they contribute to the medium. d. Prepare a growing media to specifications, or identify the components and proportions in a commercially prepared root medium and discuss/explain the advantages of a commercial root medium over media containing natural soil.	**Teaching:** • Have students read Unit 4 in Reiley and Shry and answer the questions in the self-evaluation. E2, E4, E10 • Have students bring soil samples from home and complete an assignment to classify soil texture. A1, A2 • Have students prepare a growing medium from components on hand or take a sample from a growing medium they are using and identify the components of the medium and the approximate/relative proportion of the components of the medium, identifying the characteristics imparted to the medium by each component. A1, A2, A5, A8 **Assessment:** • Evaluation of student performance on self-evaluation. • Teacher observation and evaluation of soil texture assignment using a checklist. • Teacher observation and evaluation of growing medium analysis using a checklist. • Teacher-constructed test on soil and growing media.
2. Describe and apply basic principles of plant nutrition. a. Identify the major nutrients needed for plant growth and describe their effects on plant growth. b. Identify the minor nutrients needed for plant growth and describe their effects on plant growth. c. Describe the effect of soil pH on nutrient availability and plant growth. d. Demonstrate the procedure for obtaining a soil sample, from a container and a land-based environment, for a soil test. e. Perform a test to determine plant or soil nutrition and interpret the results	**Teaching:** • Have students read Unit 4 in Reiley and Shry and complete the self-evaluation. E2, E4, E10 • Describe and discuss the major plant nutrients and their effects on plant growth. B2, E4 • Describe and discuss the minor plant nutrients and their effects on plant growth. B2, E4 • Have students draw a pH scale and indicate the following points: acid range, neutral, alkaline range, and range of best plant growth. Have students explain and describe how and what amendments to apply to the soil to modify the acidity or

Competencies and Suggested Objectives	Suggested Strategies for Competencies
to determine the amendments to be made to a given area of root medium to facilitate/produce optimum plant response. f. Interpret fertilizer analysis in terms of major nutrient content. g. Investigate new and emerging technologies, practices, trends, and issues associated with fertilizers and plant nutrition.	alkalinity of a root medium. A1, A2, A5, B2, B7, E4 • Demonstrate how to, and have students collect a soil sample (or petiole sample) from a plant, a container, or a land-based lab area and perform a test. Have students interpret the test results and make suggestions on amendments and nutrients that need to be added to the root medium. A1, A2, A5, B2, E4, E10 • Explain the legal requirements for the three analysis numbers on a fertilizer container and explain what each represents. Have students complete an assignment to calculate the actual nutrient content (in pounds) in a given amount of fertilizer. Discuss/lecture on the effect of pH on the availability of these nutrients. A1, A2, A5, B2, E4, E10 • Discuss the role of the EPA in the requirements of ground water and run-off water as they impact commercially applied fertilizers in agricultural applications. Explain the USDA applications of riparian strips in agricultural applications and their relation to the quality of water in streams and rivers. B2 **Assessment:** • Evaluation of student performance on self-evaluation activity. • Evaluation of student assignment to draw the pH scale using a checklist. • Evaluation of student assignment to collect a soil or petiole sample using a checklist. • Teacher-constructed test on plant growth, media, and fertility.

STANDARDS

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LEA 1	Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2	Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 1	Know and understand the importance of professional ethics and legal responsibilities.
ELR 2	Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.
PLT 1	Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 3	Apply fundamentals of production and harvesting to produce plants.
TET 1	Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1	Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
NRS 1	Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS 3	Apply scientific principles to natural resources management activities.
NRS 4	Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS 5	Practice responsible conduct to protect natural resources.
ENV 1	Use analysis procedures to plan and evaluate environmental service impacts.
ENV 2	Identify public policies and regulations impacting environmental services to determine their effect on facility operation.
ENV 3	Apply scientific principles to environmental services.
ENV 5	Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1	Recognize, classify, and use real numbers and their properties.
A2	Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5	Utilize various formulas in problem-solving situations.
B2	Investigate the biochemical basis of life.
B7	Investigate the interdependence and interactions that occur within an ecosystem.
E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Agriculture research magazine [Electronic Version]. Retrieved October 13, 2004, from www.ars.usde.gov/is/AR

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Pearson Prentice Hall.

Jacks, L. P., & Hamilton, J. R. (1997). *Basic principles of soil science*. Mississippi State, MS: Research and Curriculum Unit.

MAFES research highlights [Electronic Version]. Mississippi State, MS: Mississippi Agricultural and Forestry Experiment Station. Retrieved October 13, 2004, from www.msucares.com/pubs/highlights/index.htm

MSU CARES [Electronic Version]. Retrieved October 13, 2004, from the Mississippi State University Extension Service and the Mississippi Agricultural and Forestry Experiment station web site: www.msucares.com

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Stiegler, J. H. (n.d.). *Land judging in Oklahoma*. Stillwater, OK: Oklahoma Cooperative Extension Service.

Horticulture I
Unit 5: Horticulture Structures **(10.5 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe the characteristics and features of different types of greenhouses. a. Identify and compare the different styles of greenhouses (Quonset, Gothic, lean-to, A-frame, etc.). b. Identify and compare the different types of greenhouse frames (metal, wood, plastic/PVC, etc.) and coverings (fiberglass, glass, polyethylene, lexon, etc.). c. Identify and compare the different types of heating, cooling, and ventilation systems used in greenhouses. d. Identify and compare the types of irrigation and chemigation systems used in greenhouses. e. Identify and describe factors to consider in establishing a floor plan for a greenhouse including benching, flooring, and traffic patterns. f. Describe sanitation practices employed in greenhouse production.	**Teaching:** • Have students read Chapter 19 in Ingels and complete the Achievement Review. E3, E4 • Have students view the *Greenhouses* Power Point presentation. E3 • Hold classroom discussion on the different types of greenhouses and systems used in greenhouse plant production. A1, A2, B4, B7, E2, E4, E9, E10 • Visit local greenhouses to observe systems in operation. **Assessment:** • Assessment of student performance in completing the Achievement Review. • Teacher observation of student participation on class discussion. • Teacher-constructed test on greenhouse styles and systems.
2. Describe auxiliary structures associated with horticulture. a. Describe the functions of auxiliary structures associated with horticultural operations including lathe houses, cold frames, shade houses, hot beds, mist benches, potting facilities, chemical and dry storage facilities, etc.	**Teaching:** • Hold classroom discussion on other structures and systems used in horticultural plant production. E2, E4 **Assessment:** • Teacher-made test on auxiliary structures.
3. Investigate and explore new and emerging technologies associated with greenhouse and other horticultural systems and structures.	**Teaching:** • Have students investigate and explore new and emerging trends and issues related to greenhouse structures and systems. Have students summarize their findings and present to the class. E1, E2, E3, E4, E5, E9, E10 **Assessment:** • Evaluate class presentation for content, clarity, length, and eye contact.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 1 Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
STR 2 Read and relate structural plans to specifications and building codes.
STR 3 Examine structural requirements to estimate project costs.
STR 4 Develop skills required to use construction/fabrication equipment and tools.
STR 5 Plan implement manage, and/or provide support services for facility design and construction, equipment design, manufacture, repair, and service; and agricultural technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC 2 Use available power sources to plan and apply control systems.
ENV 4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV 5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
B4 Investigate the transfer of energy from the sun to living systems.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Biondo, R. J. (2004). *Greenhouse production.* Englewood Cliffs, NJ: Prentice Hall.

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Prentice Hall.

Greenhouse business [Electronic Version]. Palatine, IL: Greenhouse Business. Retrieved October 13, 2004, from www.greenhousebiz.com

Greenhouse product news [Electronic Version]. Des Plaines, IL: Scranton-Gillette Communications. Retrieved October 13, 2004, from www.gpnmag.com

Ingels, J. E. (2001). *Ornamental horticulture: Science, operations & management* (3rd ed.). Clifton Park, NY: Delmar.

Koster, J., Marsh, P., Wade, J., Maneri, N., Doree, D., Neid, J., et.al. (2000). *Greenhouses* [Power Point presentation]. Retrieved October 13, 2004, from the Glen Rose FFA Chapter Web site: http://www.glenroseffa.org/greenhou.ppt

Schroeder, C. B., Seagle, E. D., Felton, L. M., Ruter, J. M., Kelley, W. T., & Krewer, G. (2004). *Introduction to horticulture (4th ed.)*. Englewood Cliffs, NJ: Prentice Hall.

Horticulture I
Unit 6: Basic Plant Propagation **(30 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Distinguish between sexual and asexual propagation. a. Describe the distinguishing characteristics of sexual and asexual propagation. b. Explain the advantages and disadvantages of each.	**Teaching:** • Use presentation media to describe and discuss with the students the characteristics, advantages, and disadvantages of sexual and asexual propagation. B2, B3, E2, E4, E9, E10 **Assessment** • Teacher-constructed test on characteristics, advantages, and disadvantages of sexual and asexual propagation.
2. Apply principles of sexual reproduction. a. Describe the sexual reproductive process in plants. b. Identify the parts of a seed and describe their functions. c. Identify requirements for optimum seed germination of most seeds. d. Propagate plants from seed. e. Interpret information found on a seed tag.	**Teaching:** • Have students read Unit 6 in Reiley and Shry, and complete the self-evaluation activity. E3, E4, B2, B3 • Discuss the process of sexual propagation with students. B3, E2, E4, E9 • Have students dissect a monocot and dicot seed: separate, identify, and explain the function of the three main parts. B2, B3 • Discuss with the students and illustrate the conditions required for optimum germination of most seeds. B2, B3, E2, E3, E4, E9 • Have students make a germination chamber from a sandwich bag and paper towel and journal the progress of seed germination. A1, A2, B1, B2, B3, E1, E10 • Provide the students with a seed tag or seed package (or copy of) and explain the various components of the tag/package. Explain the legal requirements of a seed tag, and identify the USDA as the governmental agency that requires the tag. E3, E4, E10 **Assessment:** • Evaluation of unit self-evaluation. • Teacher observation/evaluation of dissection using a checklist. • Teacher observation/evaluation of the seed germination journal using a checklist

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	or rubric. • Teacher-constructed test on plant sexual reproduction.
3. Describe and apply principles of asexual reproduction. a. Identify the common types of asexual reproduction and discuss their applications in horticulture. b. Identify common tools and chemicals used in asexual reproduction and demonstrate their safe use and care. c. Propagate plants from root, stem, and leaf cuttings. d. Propagate plants by division/ separation. e. Propagate plants by layering.	**Teaching:** • Have students read Units 7, 8, 9, and 12 in Reiley and Shry and complete the self-evaluations for each unit. B2, B3, E2, E3, E4, E10 • Demonstrate the safe use of knives, hand pruning shears, and scalpels and their cleaning, disinfection, and maintenance; and have students use them according to direction. Demonstrate and discuss the variety, advantages, and safe use of rooting hormones. E2, E3, E4, E10 • Discuss/demonstrate the components, use, and advantages of an intermittent mist system. E2, E3, E4, E10 • Have students work in small groups to produce a project which includes the reproduction of plants by each of the asexual methods. E2, E3, E4, E10 **Assessment:** • Assessment of self-evaluations from text. • Evaluation of student activity in using tools used in asexual reproduction (checklist). • Evaluation of student activity to reproduce plants asexually. • Teacher-constructed test on plant reproduction.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, Career Cluster Resources for Agriculture, Food, and Natural Resources. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.

TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Prentice Hall.

Jacks, L. P. (n.d.). *Basic principles of plant science*. Mississippi State, MS: Research and Curriculum Unit.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture I
Unit 7: Principles of Pest Management (22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify and describe factors common to pest management and control. a. Identify and describe the different types of plant pests. b. Identify and describe the different types of control and management practices for plant pests. c. Describe and discuss principles of integrated pest management. d. Describe requirements for pesticide applicator's certification/licensure.	**Teaching:** • Have students read Unit 16 in Reiley and Shry and complete the self-evaluation. E1, E3, E4, E9, E10 • Using presentation media, identify and describe the different types of plant pests (insects, diseases, weeds, and small animals). B7 • Using presentation media, identify and describe the different types of control and management practices for plant pests (cultural, mechanical, biological, and chemical). B7 • Describe and discuss with the students how the different methods can be used together for optimum control and management of plant pests. B7, E4, E9, E10 • Have students research standards for pesticide applicator's licensure and certification and complete an assignment sheet. E1, E3, E4, E9, E10 **Assessment:** • Evaluation of student performance on self-evaluation. • Evaluation of assignment on applicator certification and licensing. • Teacher-constructed test on factors common to pest management and control.
2. Identify, describe, and apply pesticide safety procedures. a. Identify and describe the use of different types of pesticides. b. Interpret pesticide label information. c. Discuss and apply general precautions for working with pesticides. d. Describe first-aid procedures for exposure to pesticides.	**Teaching:** • Have students read Unit 17 in Reiley and Shry and complete the self-evaluation. E1, E3, E4, E9, E10 • Using presentation media, identify and describe the use of different types of pesticide (insecticides, herbicides, fungicides, etc.). • Provide students with an example of a pesticide label and identify the 11 standard points that are required by law, including signal words. E3, E4 • Discuss with the students the general precautions to follow in working with

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	pesticides and their applications on the job. E2, E4, E9, E10 • Use presentation media to describe different types of exposure and appropriate first-aid procedure. Have students complete an assignment regarding exposure methods and procedures to follow for accidental exposure by each method. E1, E2, E4 **Assessment:** • Evaluation of student performance on self-evaluation activity. • Evaluate student performance using a checklist on assignment to identify exposure methods and first-aid procedures. • Teacher-constructed test on pesticide safety.
3. Identify common plant pests, and describe the ways in which they cause damage to horticultural crops. a. Identify common insect pests of horticultural crops and describe how each causes damage to the crop. b. Identify common diseases of horticultural crops and describe how each causes damage to the crop. c. Identify common weeds found in horticultural crops and describe how weeds cause damage to crops. d. Monitor greenhouse and nursery product for pest management and control. (on-going throughout the year)	**Teaching:** • Have students read Units 18-20 in Reiley and Shry and complete the self-evaluation activity for each unit. E1, E3, E4, E9, E10 • Using presentation media, identify and discuss common insect pests and describe how these pests damage crops (sucking and chewing). B7 • Using presentation media, identify and discuss weeds and describe how weeds damage crops through competition. B7, E4, E9, E10 • Using presentation media, identify and discuss common diseases of plants and describe the vectors that transmit disease. B7, E4, E9, E10 • Have students work in small groups to monitor the school greenhouse and nursery area for pest control and management and record and report their findings. B7, E1, E4, E9 **Assessment:** • Evaluate student performance on self-evaluation activities. • Evaluation of student performance in monitoring pest management and control practices (checklist).

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Teacher-constructed test on plant pests, damage and control.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
ENV 1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV 2 Identify public policies and regulations impacting environmental services to determine their effect on facility operation.
ENV 3 Apply scientific principles to environmental services.

Academic Standards

B3 Investigate cell structures, functions, and methods of reproduction.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Prentice Hall.

Caffee, J. (n.d.). *Integrated pesticide management* [PowerPoint presentation]. Retrieved October 11, 2004, from the Glen Rose FFA Chapter Web site: www.glenroseffa.org

Oska, C. (n.d.). *Pesticide management* [PowerPoint presentation]. Retrieved October 11, 2004, from the Glen Rose FFA Chapter Web site: www.glennroseffa.org

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture I
Unit 8: Basic Principles of Floristry (22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply basic principles of floristry. a. Identify tools and supplies used in floristry including shears, tape, foam, floral wire, etc. b. Demonstrate the safe and proper use of tools and supplies used in floristry including shears, tape, foam, floral wire, etc. c. Identify plant materials used in floristry including potted, flower, and foliage materials. d. Describe basic design principles including balance, transition, rhythm, focal point, proportion, scale, etc. e. Create basic floral design products such as a packaged single corsage, wreath, bud vase, round centerpiece, or a dressed (wrapped) potted plant.	**Teaching:** • Use a display or media presentation to identify floral tools and supplies and describe their use. • Have students complete exercises to demonstrate the safe and proper use of floral design tools and supplies. • Use a display of specimens or presentation media on plant materials used in floristry to identify plant materials. • Use discussion and presentation media to describe and show applications of basic floral design principles. • Demonstrate through an illustrated lecture, the creation of basic floral design products such as a packaged single corsage, bud vase, round centerpiece, and a dressed (wrapped) potted plant. Divide students into small groups and have them design and construct these products. E4, E10 **Assessment:** • Assessment of student performance in the use of floral design tools and supplies using a checklist. • Assessment of student performance in designing and constructing floral designs using a checklist. • Teacher-constructed test on tools, supplies and materials; and basic principles of floral design.
2. Describe and apply principles of interior plantscaping. a. Describe factors to consider in growing and maintaining plants for interior plantscaping including plant environment, light sources, growing media, fertilization, etc. b. Identify foliage and potted plants used in interior plantscape. c. Describe and discuss procedures for	**Teaching:** • Use presentation media to allow students to discover and discuss factors to consider in growing and maintaining plants for interior plantscaping. E4, E10 • Use a display of specimens or presentation media to identify foliage and potted plants used in interior plantscaping. • Use an illustrated lecture or field trip to

Competencies and Suggested Objectives	Suggested Strategies for Competencies
planning, constructing, and maintaining an interior plantscape.	discuss the procedures for constructing and maintaining an interior plantscape. When possible, assign students to perform these tasks throughout the year. [B4] **Assessment:** • Evaluation of student performance in planning, constructing, and maintaining an interior plantscape. • Teacher-constructed test on interior plantscape materials and on principles and procedures for planning, constructing, and maintaining an interior plantscape.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 2 Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.

Academic Standards

B4 Investigate the transfer of energy from the sun to living systems.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

Griner, C. P. (2002). *Floriculture: Designing & merchandising.* Albany, NY: Delmar.

Handbook of flowers, foliage and creative design. (2002). Clifton Park, NY: Delmar Learning.

Rankin, D. (2002). Floral Design [Computer software]. Clifton Park, NY: Delmar.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Schroeder, C. B., Seagle, E. D., Felton, L. M., Ruter, J. M., Kelley, W. T., & Krewer, G. (2004). *Introduction to horticulture* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Horticulture I
Unit 9: Greenhouse Crops **(22.5 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of greenhouse crop production. a. Identify different types of greenhouse crops (bedding plants, vegetables, flowering plants, foliage plants, etc.) and common species of each type. b. Describe cultural considerations for greenhouse crops including fertilizer, water, growing medium, pest control, temperature, natural and chemical growth control and stimulation, and light control for common crops. c. Produce a greenhouse crop following accepted commercial practices. (ongoing throughout the year)	**Teaching:** • Have students read Units 13-15, 23, and 25 of Reiley and Shry and complete the self-evaluation activity for each unit. E3, E4, E10 • Using presentation media and specimens, when available, identify common types and species of greenhouse crops commonly grown in Mississippi. E3 • Identify and discuss with the students cultural considerations for a specific bedding plant, flowering plant, and foliage plants. A1, A2, A5, B2, B3, B4, B7, E3, E4 • Divide students into groups and assign specific tasks to each group in regards to growing out a commercial greenhouse crop. Rotate the groups over the growing period, so that each group completes all tasks in regards to the growing of the crop. B2, B3, B4, B7, E2, E4 **Assessment:** • Evaluation of self-evaluation activities for Units 13-15, 23, and 25 in Reiley and Shry. • Evaluation of student performance on tasks associated with growing out specific greenhouse crops using a rubric or checklist. • Teacher-constructed test on types of greenhouse crops and cultural considerations in raising these crops.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

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LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives

LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 2 Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.
PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC 2 Use available power sources to plan and apply control systems.
NRS 1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS 2 Use effective venues to communicate natural phenomena to the public.
NRS 3 Apply scientific principles to natural resources management activities.
NRS 4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS 5 Practice responsible conduct to protect natural resources.
ENV 1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV 2 Identify public policies and regulations impacting environmental services to determine their effect on facility operation.
ENV 3 Apply scientific principles to environmental services.
ENV 4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV 5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
ABS 1 Employ leadership skills to accomplish goals and objectives in the Agriculture, Food, and Natural Resources business environment.
ABS 2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS 3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS 4 Employ AFNR industry concepts and practices to manage inventory.

Related Academic Standards

A1 Recognize, classify, and use real numbers and their properties.

Secondary Horticulture

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Pearson Prentice Hall.

Biondo, R. J. (2004). *Greenhouse production.* Upper Saddle River, NJ: Pearson Prentice Hall.

Grower product news. Des Plaines, IL: Scranton Gillette Publications. Retrieved October 12, 2004, from http://www.gpnmag.com/

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture I
Unit 10: Olericulture Production **(18 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of olericulture production. a. Describe characteristics of common vegetables grown for commercial production including cultural requirements, direct seeding versus transplanting, plant growth style, and growing season; and distinguish between warm season and cool season crops. b. Identify and demonstrate the use of common tools and equipment used in gardening including tillers, spreaders, sprayers, watering devices, rakes, hoes, shovels, etc. c. Identify and describe factors to consider in preparing a seedbed including soil class and texture, use of soil amendments, and characteristics of a properly prepared seedbed. d. Develop a plan for an intensive culture garden including crop and variety selection, location and spacing of different crops, scheduling of crops, crop rotation, and harvesting and marketing of crops. e. Identify common garden pests including insects, diseases, and weeds, and methods of control. f. Discuss new and emerging technologies, trends, and issues concerning the production and marketing of vegetables in Mississippi. Identify and discuss the roles of agencies and organizations that regulate the production and marketing of vegetables.	**Teaching:** • Have students identify/name vegetables they commonly eat or see in the grocery store. From the list, select those which are grown in Mississippi. Ask them to distinguish between those which are true vegetables (roots, stems, and leaves) and those which are fruits or flowers (arise from the reproductive phase of plant growth). Explain, compare, and distinguish the nominal methods of production and culture among the vegetables listed. E2, E3, E4, E10 • Have students read Unit 9 in Reiley and Shry and complete the self-evaluation. E3, E4, E10 • Have students list or name common tools used in horticulture operations and describe their uses in olericulture—explaining the crossover uses of tools common in the industry. E2, E4 • After students have completed their readings, have them develop and draw a plan for a small garden for their area, including cultural practices already described. A1, A2, E1, E4, E5, E10 • Use presentation media and specimens to identify common garden pests and describe different control methods. B7, E2, E4, E10 • Use lecture and discussion to explore the significance of new technologies and equipment such as GPS, mechanical versus hand harvesting, new organic standards, and bio-pesticides. Here is a good place to put the role of the EPA in recent banning of some chemical pest controls, and the other federal agencies which regulate the levels of pesticides allowable in processed foods, etc. Have students do research and prepare a report on a agency or new technology affecting

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	vegetable production or marketing, such as standards for organic produce; the role of genetically modified organisms (GMO's) in olericulture and their dangers and benefits;and the impact of NAFTA or the WTO in the import/export of vegetable crops. B7, E1, E2, E3, E4, E10 **Assessment:** • Teacher-made test. • Evaluation of unit self-evaluations from the text. • Assessment of student performance (using a rubric) in developing a garden plan. • Assessment of student report on new and emerging practices (checklist).

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

American vegetable grower [Electronic Version]. Willoughby, OH: Meister Media Worldwide. Retrieved October 13, 2004, from www.vegetablegrower.com

Burnham, M., Henn, A., & Harris, P. (n.d.). *Garden tabloid*. Mississippi State, MS: Mississippi State University Extension Service.

Jacks, L. P., & Hamilton, J. R. (1997). *Basic principles of soil science*. Mississippi State, MS: Research and Curriculum Unit.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture II
Unit 1: Leadership, Careers, and Safety (18 hours)
(Review and Reinforcement-Ongoing)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review program policies and procedures. a. Review program operation policies and procedures, including general safety procedures.	**Teaching:** • Provide students with written copies of policies, and procedures for the horticulture department and for the school. Have students read these policies; then, discuss them with students, asking questions to make sure that all students understand the policies, procedures, and rules. E1, E2, E3, E4, E9, E10 **Assessment:** • Students sign a statement certifying that they have received, discussed, and understand policies and procedures. • Teacher-constructed test on policies and procedures.
2. Practice leadership skills. a. Identify and discuss fundamental parliamentary procedures for participating in a public meeting. b. Identify and discuss basic principles of public speaking.	**Teaching:** • Identify and discuss with the students the basic rules of parliamentary procedure (making, seconding, and disposing of a main motion and announcing the results). Have student practice these procedures in a mock meeting, taking turns serving as chair and members of the house. E2, E4, E9, E10 • Discuss the basic principles of public speaking with the students to include parts of a speech, organizing and outlining a speech, and delivery. E2, E3, E4, E9, E10 **Assessment:** • Teacher-constructed test on fundamental parliamentary procedure and public speaking skills. Evaluation of student performance on parliamentary procedure practice using a checklist.
3. Investigate new and emerging technologies, practices, trends, and issues associated with horticulture. a. Prepare a report on a new and emerging technology associated with horticulture. b. Prepare a report on a current trend or	**Teaching:** • Have students research industry periodicals and the Internet to identify new and emerging technologies, practices, trends and issues associated with the horticulture industry. Have students prepare a written report with an oral presentation on this

Competencies and Suggested Objectives	Suggested Strategies for Competencies
issue associated with horticulture.	topic and present it to the class. E1, E2, E3, E4, E5, E9, E10 **Assessment:** • Evaluation of student's written report and oral presentation using a rubric.
4. Complete school-to-careers activities related to horticulture. a. Identify employment and career opportunities in the horticulture industry. b. Investigate educational opportunities related to horticulture at the postsecondary level. c. Describe national standards and certification/licensing procedures related to horticulture. d. Describe the role of trade organizations, associations, and unions as related to horticulture.	**Teaching:** • Have students research career and employment opportunities at the local, state, and regional level using the Internet, industry periodicals, and other sources. This research should include educational requirements, working conditions and salaries, advancement opportunities, skills required for entry, etc. Have students present their findings to the class. E1, E2, E3, E4, E5, E9, E10 • Invite representatives of community college and four-year college horticulture departments to speak to the class concerning postsecondary programs in horticulture. E2 • Invite a representative of the horticulture industry or certifying agency to speak to the class concerning certification and licensure procedures in the industry. E2 • Have students research and summarize in writing information on the role of trade organizations, associations, and unions in the horticulture industry. E1, E2, E3, E4, E5, E9, E10 **Assessment:** • Evaluation of student report and presentation on career and employment opportunities using a rubric. • Evaluation of student participation in guest speaker presentations using a checklist. • Evaluation of student's written summary on role of trade organizations, associations, etc. using a rubric.
5. Review safety rules and procedures for horticulture.	**Teaching:** • Have students review the safety rules, practices, and personal protective equipment items that are used in the horticulture industry. E2, E3, E4

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	Assessment: • Teacher-constructed test on safety rules and procedures. • Ongoing evaluation of student performance in following safety rules and procedures will be built-in to assessment of all activities and exercises throughout the year.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 1 Know and understand the importance of professional ethics and legal responsibilities.
ELR 2 Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
ABS 1 Employ leadership skills to accomplish goals and objectives in the Agriculture, Food, and Natural Resources business environment.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.

E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Kimbrell, B., & Chambers, D. (2002). *Developing safety skills for the shop and home.* Winterville, GA: American Association for Vocational Instructional Materials.

Guiler, G. S., & Woodin, R. J. (1994). *Mastering parliamentary procedure*. Columbus, OH: Ohio Curriculum Materials Service.

National Ag Safety Database. Retrieved October 11, 2004, from http://www.cdc.gov/nasd/menu/topic/topic.html

National Association of FFA. (2004). *Advisors handbook.* Indianapolis, IN: Author.

National Association of FFA. (2004). Lifeknowledge [Computer software]. Indianapolis, IN: Author.

National Association of FFA. (2004). *Student handbook.* Indianapolis, IN: Author.

Horticulture II
Unit 2: Nursery and Landscape Plant Identification (25.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify and describe the use of major plants associated with nursery and landscape operations. a. Identify and describe the use of major nursery plants including trees, shrubs, ground covers, vines, and ornamental grasses. b. Identify and describe the use of major flowering plants including annuals, biennials, and perennials. c. Identify and describe the use of major foliage plants used in nursery and landscape operations.	**Teaching:** • Using specimens, pictures, walking tours or field trips, and presentation media, to identify nursery and landscaping plants by common and scientific name. B7 • Have students compile a leaf collection of these plants showing common and scientific name and keep a log of each plant including its use and culture. B7, E1, E3, E4 **Assessment:** • Teacher evaluation of leaf collections and log books. • Teacher-made test on scientific and common names of plants, their identification and use.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Bridwell, F. M. (2003). *Landscape plants: Their identification, culture, and use.* Albany, NY: Delmar.

National FFA Organization. (2004). *Nursery and landscape plant identification*. Retrieved October 12, 2004, from www.ffa.org/ageducators/documents/lpsguide/programs/cde/cde_handbook04.pdf

National FFA Organization. (2004). *Floriculture plant identification list*. Retrieved October 13, 2004, from www.ffa.org/ageducators/documents/lpsguide/programs/cde/cde_handbook04.pdf

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture II
Unit 3: Advanced Plant Propagation **(7.5 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply advanced plant propagation methods. a. Describe, discuss, or demonstrate how to propagate plants by one method of grafting or budding. b. Describe, discuss, or demonstrate how to propagate plants from scarified or stratified seeds. c. Discuss, describe, and/or propagate plants by tissue culture.	**Teaching:** • Have students read Units 7, 10, and 11 in Reiley and Shry and complete the self-evaluation activities. E1, E2, E3, E4 • Using presentation media and/or live specimens, identify the parts of a plant involved in grafting and budding. Demonstrate at least one method to the students. B1, B2, B3, E2, E4 • Divide students into small groups and have each group perform a budding or grafting operation. B1, B2, B3, E2, E4 • Using presentation media and/or seed specimens, describe and discuss with the students the procedures and methods for scarifying and stratifying seeds. Have student demonstrate the procedures for scarification and stratification. B1, B2, B3, E2, E4 • Using presentation media, identify and discuss the procedures used in propagating plants by tissue culture as well as the advantages and disadvantages of this process. If facilities and equipment are available, have students propagate plants by tissue culture. B1, B2, B3, E2, E4 **Assessment:** • Assessment of student performance on self-evaluation activities. • Assessment of student performance in grafting or budding plants using a checklist. • Assessment of student performance in scarifying and stratifying seeds using a rubric. • Assessment of student assessment in performing tissue culture using a rubric. • Teacher-constructed test on advanced propagation methods.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

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PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Pearson Prentice Hall.

Jacks, L. P. (n.d.). *Basic principles of plant science*. Mississippi State, MS: Research and Curriculum Unit.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Rist, L. (n.d.). *Plant tissue culture* [PowerPoint Presentation]. Retrieved October 14, 2004, from the Glen Rose FFA Chapter Web site: http://www.glenroseffa.org/lesson%20plans.htm

United States Department of Agriculture, National Tree Seed Laboratory Web site: (n.d.). *The woody plant seed manual*. Retrieved October 14, 2004, from http://www.ntsl.fs.fed.us/wpsm/Genera.htm

Horticulture II
Unit 4: Horticulture Marketing and Business Procedures (7.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply marketing and business practices associated with horticulture operations. a. Maintain an inventory of plants and supplies for the horticulture program. (on-going throughout the year) b. Develop an annual calendar of activities/enterprises for a horticulture business. c. Describe factors to consider in ordering materials/supplies for an enterprise. d. Describe factors to consider in pricing products of an enterprise. e. Describe factors to consider in marketing and advertising products. f. Complete a sales transaction including providing customer service.	**Teaching:** • Discuss and demonstrate procedures for maintaining an inventory. Provide students with the ending inventory from the previous year and have students maintain this inventory throughout the current school year. A1, A2, E2, E3, E4 • Describe and discuss procedures for scheduling horticulture crops including ordering supplies and materials. Have students create a calendar to show which activities will be taking place for given enterprises throughout the year. A1, E1, E2, E3, E4 • Describe and discuss factors related to ordering supplies and materials for an enterprise including timing of the order and quantities to be ordered. E2, E3, E4 • Describe and discuss factors to consider in pricing horticultural products including supplies, competition, bench space, labor, overhead, etc. Provide students with examples of these factors and have students compute a price for a given product. A1, A2, A5, E1, E2, E3, E4 • Describe and discuss factors to consider in marketing and advertising horticulture products including advertising methods, relative effectiveness and costs, and marketing plans. Have students develop a marketing and advertising plan for a given enterprise. A1, A2, E1, E2, E3, E4 • Describe and discuss with the students procedures for providing customer service and completing sales transactions. Have students role play sales procedures. A1, A2, E2, E3, E4 **Assessment:** • Evaluate student performance in maintaining inventory records for supplies and plants (checklist). • Evaluate student activity on creating an

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	annual calendar of activities for a horticulture business (checklist). • Evaluate student accuracy in computing prices for given horticulture products. • Evaluate student performance on creating a marketing plan (checklist). • Evaluate student performance in role playing a sales transaction (checklist). • Teacher-constructed test on marketing and business procedures.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

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LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 1 Know and understand the importance of professional ethics and legal responsibilities.
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
ABS 1 Employ leadership skills to accomplish goals and objectives in the Agriculture, Food, and Natural Resources business environment.
ABS 2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS 3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS 3 Employ AFNR industry concepts and practices to manage inventory.
ABS 4 Utilize technology to accomplish AFNR business objectives.
ABS 5 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Bouchard, S. (2001). *Floriculture Promotion, advertising, & marketing* [PowerPoint presentation]. Retrieved October 11, 2004, from the Glen Rose FFA Chapter Web site: www.glenroseffa.org

Griner, C. P. (2002). *Floriculture: Designing & merchandising.* Clifton Park, NY: Delmar.

Ingels, J. E. (2001). *Ornamental horticulture: Science, operations & management* (3rd ed.). Clifton Park, NY: Delmar.

Richardson, W. B., & Moore, G. E. (1980). *Working in horticulture*. New York: McGraw-Hill.

Horticulture II
Unit 5: Container and Field Crop Production (7.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of container and field crop production. a. Describe advantages and disadvantages of container crop production. b. Identify different types and sizes of containers and compare their advantages and disadvantages. c. Describe factors to consider in selecting a site for container and field crop production. d. Identify and demonstrate the safe use of tools and equipment for container and field crop production. e Describe cultural requirements for container and field crop production including fertilizer, water, pest control, and harvesting procedures. f. Produce container and field grown plants. g. Describe automation and plug production in the nursery industry.	**Teaching:** • Have students read Unit 24 in Reiley and Shry and complete the self-evaluation activity. E1, E2, E3, E4 • Use presentation media and demonstrations to identify and apply the factors to consider in selecting a site, using tools and equipment, and cultural requirements. A1, A2, E2, E3, E4 • Have students select plants, containers, and media; and grow container and field crops. B1, B7 • Have a local grower speak to the class on automation and plug production in the nursery industry. E2 **Assessment:** • Assessment of self-evaluation activity. • Evaluation of student activity in producing container and field grown plants using a checklist. • Teacher-constructed test on site and container selection factors, cultural requirements, and safe tool and equipment usage.
2. Investigate and explore new and emerging technologies, practices, and issues associated with container and field grown nursery production.	**Teaching:** • Have students research new and emerging trends and issues in container and field crop production using current periodicals and the Internet. (Example: Environmental hazards from excess runoff from container and field grown crops.) Have students summarize their findings and present to the class. B1, B7, E1, E2, E3, E4 **Assessment:** • Evaluation of student presentations using a checklist.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
NRS 1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS 3 Apply scientific principles to natural resources management activities.
NRS 5 Practice responsible conduct to protect natural resources.
ENV 1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV 2 Identify public policies and regulations impacting environmental services to determine their effect on facility operation.
ENV 3 Apply scientific principles to environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

American Nursery and Landscape Association. (2004). *American standards for nursery stock*. Washington, DC: Author. Retrieved October 18, 2004, from http://www.anla.org/applications/Documents/Docs/ANLAStandard2004.pdf

Ingels, J. E. (2001). *Ornamental horticulture: Science, operations & management* (3rd ed.). Clifton Park, NY: Delmar.

MSU CARES. Retrieved October 18, 2004, from the Mississippi State University Extension Service and the Mississippi Agricultural and Forestry Experiment Station Web site:http://www.msucares.com

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture II
Unit 6: Floriculture Crop Production **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of floral crop production. a. Develop growing plans and schedules for a fall and a spring floral crop. b. Describe optimum production practices for specific flower crops to include benches and media, shading/light requirements, temperature, water, fertilizer, and pest control practices. c. Produce a floriculture crop (ongoing throughout the growing season for the crop).	**Teaching:** • Have students review Units 13 and 14 in Reiley and Shry. E2, E3, E4 • Have students research a specific floral crop and prepare a growing plan and schedule for the crop. B7, E1, E2, E3, E4 • Conduct a field trip if possible to observe production practices for flower crops. E2 • Use presentation media to describe and discuss production practices for flower crops. E2, E3, B7 • Divide students into small groups and assign specific tasks associated with the growth and care of a specific greenhouse crop to each group during the growing period. Rotate the groups so that all students practice all tasks over the course of the growing period for the flower crop. B2, B4, B7, E2, E3, E4 **Assessment:** • Evaluation of student growing plans and schedules using a checklist or rubric. • Evaluation of student performance in producing a flower crop using a checklist or rubric. • Teacher-constructed test on production practices for flower crops.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 2 Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC 2 Use available power sources to plan and apply control systems.
NRS 5 Practice responsible conduct to protect natural resources.
ENV 2 Identify public policies and regulations impacting environmental services to determine their effect on facility operation.
ENV 5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
ABS 2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS 3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS 3 Employ AFNR industry concepts and practices to manage inventory.

Academic Standards

B2 Investigate the biochemical basis of life.
B4 Investigate the transfer of energy from the sun to living systems.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

Secondary Horticulture

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Biondo, R. J. (2004). *Greenhouse production.* Upper Saddle River, NJ: Pearson Prentice Hall.

Biondo, R. J., & Noland, D. A. (2000). *Floriculture: From greenhouse production to floral design*. Upper Saddle River, NJ: Pearson Prentice Hall.

Grower product news. Retrieved October 12, 2004, from http://www.gpnmag.com/

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture II
Unit 7: Landscape Design **(30 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of landscape design. a. Describe careers in the landscape design field. b. Identify and demonstrate the use of tools and equipment for landscape design including computer-assisted landscape design hardware and software. c. Identify and demonstrate the methods of lettering d. Identify and demonstrate symbols used in landscape design plans. e. Describe principles of design associated with landscaping including simplicity, balance, proportion, etc. f. Prepare site analysis/needs assessment for a given site. g. Prepare a simple landscape plan to scale for a given site to include plant selection and location.	**Teaching:** • Invite a landscape designer or contractor to speak to the class on career opportunities in the landscape industry. E2 • Use a display of tools, software, and equipment for landscape design; and demonstrate their use to the students. Have students complete exercises associated with the use of tools, equipment, and software for landscape design. • Use presentation media and discussion to acquaint students with the methods of lettering. Provide students with exercises/assignments to demonstrate lettering methods used in landscape design. E1, E2, E4 • Use presentation media and discussion to identify and describe the use of different landscape plan symbols. Provide students with exercises/assignments to demonstrate the use of these symbols. E1, E2, E4 • Use photographs, landscape drawings and plans, and field trips to discuss and illustrate basic principles of landscape design. E2, E3 • Provide students with an example of a site analysis and discuss the elements and practices involved in preparing this document. Provide students with a scenario and have them prepare a site analysis. E1, E2, E3, E4 • Using the site scenario and site analysis in the step above, have students prepare a simple landscape plan to scale including plant key and symbols. A1, A2, E1, E2, E3, E4, E10 **Assessment:** • Assessment of student exercises associated with use of tools, software, and equipment for landscape design.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Assessment of student exercises associated with lettering and landscape symbols. • Assessment of student exercises to prepare a site analysis and simple landscape plan. • Teacher-constructed test on tool identification and use and principles of landscape design.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
STR 1 Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
STR 2 Read and relate structural plans to specifications and building codes.
STR 4 Develop skills required to use construction/fabrication equipment and tools.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

3D Home Architect Landscape Design Deluxe [Computer software]. (2004). Cedar Rapids, IA: Broderbund.

Angley, S., Horsey, E., & Robert, D. (2002). *Landscapes estimating & contract administration*. Clifton Park, NY: Delmar.

Bridwell, F. M. (2003). *Landscape plants: Their identification, culture, and use.* Clifton Park, NY: Delmar.

Ingels, J. E. (2004). *Landscaping principles and practices*. Clifton Park, NY: Delmar.

Landscape Plants and Trees [CD-ROM]. (1998). Clifton Park, NY: Thomson Delmar Learning.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture II
Unit 8: Landscape Installation and Construction (22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply basic principles of landscape installation and construction. a. Describe essential elements of a landscape installation contract and an estimate. b. Develop a contract and pricing estimate for the landscape plan developed by the students in Unit 7. c. Describe and discuss procedures for preparing a planting site, installing plants, and providing post-transplant care according to a landscape plan. d. Describe licensing requirements for landscape installation. e. Discuss installation of a landscape irrigation system.	**Teaching:** • Have students review examples of landscape installation contracts and estimates and identify/discuss the essential elements of each. E2, E3, E4 • Using a template, have students develop a contract and estimate for installing the landscape plan designed in the previous unit. A1, A2, A5, E1, E2, E3, E4 • Using photographs and other presentation media, describe and discuss procedures for site preparation, installation, and post-transplant care of a landscape project. Where possible, have students work as a group to prepare a planting site, install plants, and provide post-transplant care. E2, E3, E4 • Invite a landscape contractor or representative of the landscape industry to speak to the class on licensing requirements. E2 • Using presentation media, identify the components of an irrigation system and discuss their installation and operation. Take a field trip to observe installation of an irrigation system if possible. E2, E3, E4 **Assessment:** • Assessment of student assignment to create a contract and price estimate. • Assessment of individual student participation in the preparation, planting, and care of landscape plants (when performed). • Teacher-constructed test on principles associated with contracts, estimates, installation, and irrigation.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1	Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2	Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
PLT 4	Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1	Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1	Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 1	Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
STR 3	Examine structural requirements to estimate project costs.
STR 4	Develop skills required to use construction/fabrication equipment and tools.
STR 5	Plan implement manage, and/or provide support services for facility design and construction, equipment design, manufacture, repair, and service; and agricultural technology.
NRS 1	Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS 5	Practice responsible conduct to protect natural resources.

Academic Standards

A1	Recognize, classify, and use real numbers and their properties.
A2	Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5	Utilize various formulas in problem-solving situations.
E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Angley, S., Horsey, E., & Robert, D. (2002). *Landscapes estimating & contract administration*. Clifton Park, NY: Delmar.

Bridwell, F. M. (2003). *Landscape plants: Their identification, culture, and use.* Clifton Park, NY: Delmar.

Ingels, J. E. (2004). *Landscaping principles and practices*. Clifton Park, NY: Delmar.

Ingels, J. E. (2001). *Ornamental horticulture, science, operations & management*. Clifton Park, NY: Delmar.

Landscape Plants and Trees [CD-ROM]. (1998). Clifton Park, NY: Thomson Delmar Learning.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Siciliano, P. (2005). *Landscape interpretations*. Clifton Park, NY: Delmar.

Horticulture II
Unit 9: Landscape Maintenance **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of landscape maintenance. a. Discuss skills required for year-round landscape maintenance. b. Identify and demonstrate the safe use of equipment and hand tools for landscape maintenance. c. Identify and discuss the proper procedures for pruning trees and shrubs. d. Determine and discuss fertilizer and pest control needs of trees, shrubs, and beds. e. Develop cost estimate for maintenance of trees, shrubs, and beds. f. Discuss maintenance of a landscape irrigation system. g. Describe elements of a contract and warranty agreement for landscape maintenance.	**Teaching:** • Invite a resource person from the landscape maintenance industry to speak to the class on year round maintenance and associated skills. E2 • Demonstrate the safe and proper use of landscape maintenance tools to the students. Have students complete a series of activities demonstrating the safe and proper use of these tools. • Discuss and demonstrate procedures for pruning trees and shrubs with the students. Have students work in small groups, when possible, to prune trees and shrubs. E2, E4 • Review procedures for collecting soil samples and interpreting soil test results. Also review common landscape pests and their control. Have students complete an assignment to calculate fertilizer requirements and pest control practices for a given scenario. A1, A2, A5, E2, E3, E4 • Provide students with an example of a cost estimate for landscape maintenance and have them identify key elements and practices. Have students complete an assignment to develop a cost estimate for a given scenario. A1, A2, A5, E1, E2, E3, E4 • Using presentation media and field trip, if possible, discuss maintenance procedures for an irrigation system. E2, E4 • Using examples of contracts and warranty agreements, have students identify and describe key elements and practices. Have students complete an assignment to develop a sample contract and warranty agreement. A1, A2, A5, E1, E2, E3, E4 **Assessment:** • Evaluation of student performance regarding the safe and proper use of landscape maintenance tools using a checklist. • Evaluation of student assignment to

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	calculate fertilizer requirements and determine pest control measures for a given scenario using checklist. • Evaluation of student assignment to develop a cost estimate (checklist). • Evaluation of student assignment to develop a contract and warranty agreement using a rubric. • Teacher-constructed test on principles of landscape maintenance.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 2 Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.
PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 3 Examine structural requirements to estimate project costs.
STR 4 Develop skills required to use construction/fabrication equipment and tools.
STR 5 Plan implement manage, and/or provide support services for facility design and construction, equipment design, manufacture, repair, and service; and agricultural technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC 2 Use available power sources to plan and apply control systems.

NRS 1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS 5 Practice responsible conduct to protect natural resources.
ENV 1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV 2 Identify public policies and regulations impacting environmental services to determine their effect on facility operation.
ENV 5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
ABS 1 Employ leadership skills to accomplish goals and objectives in the Agriculture, Food, and Natural Resources business environment.
ABS 2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS 3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS 3 Employ AFNR industry concepts and practices to manage inventory.
ABS 4 Utilize technology to accomplish AFNR business objectives.
ABS 5 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

Secondary Horticulture

WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

Angley, S., Horsey, E., & Robert, D. (2002). *Landscapes estimating & contract administration*. Clifton Park, NY: Delmar.

Bridwell, F. M. (2003). *Landscape plants: Their identification, culture, and use.* Clifton Park, NY: Delmar.

Ingels, J. E. (2004). *Landscaping principles and practices*. Clifton Park, NY: Delmar.

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Melby, P. (1995). *Simplified irrigation design*. Chicago: American Nurseryman.

National Ag Safety Database. (n.d.). Retrieved October 11, 2004, from http://www.cdc.gov/nasd/menu/topic/topic.html

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture II
Unit 10: Turfgrass Installation and Maintenance (15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of turfgrass installation. a. Describe factors to consider in selecting a turfgrass for a specific area. b. Identify varieties of turfgrass and describe their characteristics. c. Describe installation practices for different turfgrasses including site preparation and initial care. d. Develop a plan and cost estimate for establishing turf.	**Teaching:** • Have students read Unit 35 in Reiley and Shry and complete the self-evaluation activity. E1, E2, E3, E4 • Take students on a tour of the campus and local area. Identify common varieties of turfgrass and their characteristics. Hold a class discussion on varieties of turfgrass and their characteristics, uses, and limitations. E2, E4 • Provide students with a copy of *Establish and Manage Your Home Lawn* from Mississippi State University Extension Service. Discuss installation for different turfgrasses commonly grown in Mississippi. E2, E3, E4 • Demonstrate the procedure for developing a plan and cost estimate for establishing turf. Have students complete their own plan for a given job. A1, A2, A5, B7, E1, E2, E3, E4 **Assessment:** • Evaluation of self-evaluation activity. • Teacher observation (using a checklist) of student participation on tour and in classroom discussion. • Evaluation of student plan and cost estimate using a rubric. • Teacher-constructed test on turfgrass identification and installation.
2. Describe and apply principles of turfgrass maintenance. a. Identify and demonstrate the safe use of equipment and tools used for turfgrass maintenance including mowers, dethatchers, aerators, etc. b. Mow turf to correct height for a specific grass. c. Identify common pests of turfgrass including insects, diseases, and weeds. d. Calibrate equipment and apply fertilizer to turf in correct proportions. e. Calibrate equipment and apply	**Teaching:** • Teacher demonstration of operation of power equipment, stressing the safe use of the equipment and precautions to be followed. Take students on a field trip if necessary to view equipment in operation. Allow students to operate equipment under close supervision if possible. E2, E3, E4 • Mini-lecture on proper moving height and techniques for different grasses. E2 • Use a PowerPoint presentation to identify the most common insect, weed, and

Competencies and Suggested Objectives	Suggested Strategies for Competencies
herbicides, pesticides, and other pest control chemicals in correct proportions. f. Describe common irrigation methods for turfgrass. g. Perform repair/renovation practices including aeration and dethatching. h. Develop a plan/cost estimate for a turfgrass management program.	disease pests of turf; their symptoms; and their control. [E2, E3] • Demonstrate the procedure for calibrating a sprayer and spreader. Provide students with a given scenario and have them recalibrate to specifications. [A1, A2, A5, E2, E3 E4] • Class discussion and field trip to view different types of irrigation systems and equipment. [E2] • Demonstrate turf repair and renovation procedures and equipment to students. Allow students to operate the equipment under close supervision if possible. If equipment is not available, take students on a field trip to let them see the equipment in operation. [E2, E3, E4] • Provide students with a sample plan and a scenario where they have to develop a simple plan for turf management. [B7, E1, E2, E3, E4] **Assessment:** • Assessment of students in operating turf equipment using a checklist. • Assessment of student performance on activity to recalibrate a sprayer or spreader. • Assessment of student performance in repairing and renovating turf. • Assessment of student performance (using a checklist) in developing a plan for turf management. • Teacher-constructed test on principles and procedures for turfgrass management.
3. Demonstrate safe and proper maintenance of turf equipment.	**Teaching:** • Demonstrate common maintenance procedures for power equipment to the students. Have students perform these activities in small groups. [E2, E3, E4] **Assessment:** • Evaluation of student performance on maintenance activities using a checklist.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Agnew, M. L., & Christians, N. E. (n.d.). *The mathematics of turfgrass maintenance*. Lawrence, KS: Golf Course Superintendents Association of America.

Nagel, D., Harris, P., Patel, M., & Byrd, J, D. (n.d.). *Establish and manage your home lawn*. Mississippi State, MS: Mississippi State University Extension Service.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Schroeder C. B., Seagle, E. D., Felton, L. M., Ruter, J. M., Kelley, W. T., & Krewer, G. (2004). *Introduction to horticulture* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Schroeder, C. B., & Sprague, H. B. (1996). *Turf management handbook*. Englewood Cliffs, NJ: Pearson/Prentice Hall.

Horticulture II
Unit 11: Pomology Production **(7.5 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and apply principles of fruit and berry production. a. Identify common fruits and berries produced in Mississippi and discuss general cultural practices. b. Prepare a site or describe/explain how to prepare a site and install fruit or berry plants common to Mississippi. c. Provide or explain/describe how to provide cultural care for fruit or berry plants commonly grown in Mississippi, to include pruning, fertilizing, pest control, and harvesting. d. Describe marketing of fruits and vegetables. e. Identify and discuss local, state, national, and international organizations that impact fruit and berry production.	**Teaching:** • Have students read Units 42-45 of Reiley and Shry and complete the self-evaluation activity. E1, E2, E3 • Have students compile a report on one fruit or berry crop which discusses site preparation, variety selection, installation, cultural practices, and harvesting and marketing. Have students present a summary of their findings to the class. B7, E1, E2, E3, E4, E5, E9, E10 • Discuss the roles of local, state, national, and international organizations that regulate or impact the production and marketing of fruit and berry crops in Mississippi, such as Mississippi Department of Plant Industry, USDA, OSHA, NAFTA, and the WTO. E2, E3, E4 **Assessment:** • Evaluate student performance on self-assessment activities. • Evaluate student performance on compiling and presenting a report on a fruit or berry crop. (Use checklist or rubric.) • Teacher-constructed test on fruit and berry production.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

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PLT 1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT 2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT 3 Apply fundamentals of production and harvesting to produce plants.

TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

American fruit grower. (n.d.). Willoughby, OH: Meister Media Worldwide.

MSU CARES. Retrieved October 14, 2004, from the Mississippi State University Extension Service and the Mississippi Agricultural and Forestry Experiment station web site: www.msucares.com

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Horticulture II
Unit 12: Advanced Floral Design **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review and reinforce principles of floristry. a. Demonstrate the procedures for receiving and storing (including rotation of inventory) of floral materials. b. Review and apply basic design principles including balance, transition, rhythm, focal point, proportion, scale, etc. c. Receive and process orders for floral products. d. Create an advanced floral design product such as a hogarth curve, fan, right or left triangle, diagonal, etc.	**Teaching:** • Discuss with students procedures for receiving and storing floral materials. E2, E4 • Review basic design principles. E2, E4 • Discuss procedures for receiving and processing orders for floral design. Have students complete an order for a floral product. A1, A2, E1, E2, E4 • Divide students into groups and assign a specific design to be completed by each group. E2, E3, E4 **Assessment:** • Evaluation of student performance in receiving and processing an order for a floral product. • Evaluation of student participation in group activity to design an advanced floral design. • Teacher-constructed test on receiving and storing materials, receiving and processing orders, and basic principles of design.

STANDARDS

Agriculture, Food, and Natural Resources (AFNR) Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR 1 Know and understand the importance of professional ethics and legal responsibilities.
ELR 2 Demonstrate workplace ethics specific to AFNR (Agriculture, Food, and Natural Resources) occupations.
PLT 4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.

TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
ABS 2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS 3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS 3 Employ AFNR industry concepts and practices to manage inventory.
ABS 5 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools

Secondary Horticulture

T6 Technology problem-solving and decision-making tools

Suggested References

Griner, C. P. (2002). *Floriculture, designing & merchandising.* Albany, NY: Delmar.

Handbook of flowers, foliage and creative design. (2002). Clifton Park, NY: Delmar.

Rankin, D. (2002). Floral Design [Computer software]. Clifton Park, NY: Delmar.

Reiley, H. E., & Shry, C. L. (1997). *Introductory horticulture* (5th ed.). Clifton Park, NY: Delmar.

Schroeder, C. B., Seagle, E. D., Felton, L. M., Ruter, J. M., Kelley, W. T., & Krewer, G. (2004). *Introduction to horticulture* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Microscope (1 per 4 students)
2. Soil mixer
3. Soil sterilizer
4 Greenhouse (minimum size 30' x 100') with lighting, heating, and ventilation systems (2 per program recommended)
5. Potting bench
6. Misting system with timer
7. Greenhouse benches
8. Lathe house (minimum size 50' by 40')
9. Fertilizer proportioner
10. Hand pushed tilt truck
11. Powered pole pruner
12. Germination chamber/seed incubator
13. Plant mobile with florescent light
14. Chemical storage cabinet
15. Power-operated pressure sprayer
16. Floral cooler
17. Powered posthole digger
18. Front tine tiller
19. Rear tine tiller
20. Tractor with field equipment (disk, harrow, cultivator, spreader, sprayer, aerator, etc.)
21. Water pool with recirculating pump
22. Microcomputer with CD-ROM, SVGA graphics, (1 per 4 students)
23. Mulching machine/shredder
24. Rotary mower, self-propelled
25. String trimmer
26. Dethatcher
27. Lawn roller
28. Leaf blower/vacuum
29. Small engine for training
30 Sprayer calibration kit
31. Trailer
32 Automatic seeder
33. Chainsaw
34. Riding lawn mower/garden tractor

NON-CAPITALIZED ITEMS

1. Plant press (1 per student)
2. First-aid kit
3. Fire extinguisher

4. pH meter
5. Soil test kit
6. Soil salinity meter
7. Soil probe
8. Day/night timer
9. Heating pads or cables for hotbed
10. Shade cloth for greenhouse
11. Emergency backup heater
12. Water hoses with racks or reels
13. Watering nozzles and breakers
14. “Hose-on” sprayer
15. Buckets
16. Wheelbarrow
17. Greenhouse cart
18. Flat carrier
19. Trash cans
20 Sink with running water
21. Hedge shears
22. Lopping shears
23. Hand pruners
24. Manual pole pruner
25. Hand trowel
26. Grafting knife
27. Pruning saws
28. Hand pump pressure sprayer (3 per program)
29. Respirator
30. Face mask
31. Safety gloves
32. Protective suit
33. Safety goggles/glasses with monitor case
34. Floral shears
35. Ribbon shears
36. Glue guns
37. Picking machine
38. Wire cutters
39. Glue pans
40. Small engine tool set–pliers, screwdrivers, small wrenches, sockets, etc.
41. Hoes
42. Garden rakes
43. Leaf rakes
44. Pitchforks
45. Pick
46. Potato forks
47. Scuffle hoe
48. Round point shovels
49. Square point shovels

50. Axe
51. Kaiser blade
52. Sledge hammer
53. Claw hammer
54. Manual posthole digger
55. Fertilizer spreader
56. Files
57. Bench grinder
58. Power drill
59. Hand held circular saw
60. Measuring tape
61. Extension cords
62. Light meter
63. Hand misters
64. Measuring cups and spoons
65. Tissue culture kit
66. Cash register
67. Calculator
68. Sales slip dispenser
69. Filing cabinet
70. Soil temperature meter
71. Minimum/maximum registering thermometer
72. Drafting tables
73. Drafting tools and instruments
74 Lawn edger
75. Hedge trimmer
76 Lawn blower
77. Soil plugger
78. Bulb planter
79. Aerator, hand pushed
80. Wreath frame system

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Digital still camera
2. Digital projector
3. Projection screen
4. VGA device (1)
5. Overhead projector
6. Video camcorder
7. VCR/DVD
8. TV/monitor
9. Career software package
10. Compound video camera with microscope adapter

11. Plant growth models
12. Landscape design software package
13. Plant identification kit (slides or CD-ROM software)
14. Plant disease identification kit (slides or CD-ROM software)
15. Insect identification kit (slides or CD-ROM software)
16. Cart, AV

Student Competency Profile for Horticulture I

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Horticulture Orientation and Leadership Development

_____1. Identify school and program policies and procedures related to the horticulture program.
_____2. Demonstrate basic and fundamental safety practices related to horticulture enterprises.
_____3. Identify and describe the role of organizations that encourage leadership development.
_____4. Participate in leadership development activities.

Unit 2: Plant Structure and Growth

_____1. Identify parts of a plant and their functions.
_____2. Describe the growth process in plants.

Unit 3: Plant Classification and Identification (Taxonomy)

_____1. Apply systems of plant classification.

Unit 4: Plant Growth Media and Nutrition

_____1. Describe and apply principles of plant growth media.
_____2. Describe and apply basic principles of plant nutrition.

Unit 5: Horticulture Structures

_____1. Describe the characteristics and features of different types of greenhouses.
_____2. Describe auxiliary structures associated with horticulture.
_____3. Investigate and explore new and emerging technologies associated with greenhouse and other horticultural systems and structures.

Unit 6: Basic Plant Propagation

_____1. Distinguish between sexual and asexual propagation.
_____2. Apply principles of sexual reproduction.

_____3. Describe and apply principles of asexual reproduction.

Unit 7: Principles of Pest Management

_____1. Identify and describe factors common to pest management and control.
_____2. Identify, describe, and apply pesticide safety procedures.
_____3. Identify common plant pests, and describe the ways in which they cause damage to horticultural crops.

Unit 8: Basic Principles of Floristry

_____1. Describe and apply basic principles of floristry.
_____2. Describe and apply principles of interior plantscaping.

Unit 9: Greenhouse Crops

_____1. Describe and apply principles of greenhouse crop production.

Unit 10: Olericulture Production

_____1. Describe and apply principles of olericulture production.

Student Competency Profile for Horticulture II

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Leadership, Careers, and Safety (Review and Reinforcement-Ongoing)

_____1. Review program policies and procedures.
_____2. Practice leadership skills.
_____3. Investigate new and emerging technologies, practices, trends, and issues associated with horticulture.
_____4. Complete school-to-careers activities related to horticulture.
_____5. Review safety rules and procedures for horticulture.

Unit 2: Nursery and Landscape Plant Identification

_____1. Identify and describe the use of major plants associated with nursery and landscape operations.

Unit 3: Advanced Plant Propagation

_____1. Describe and apply advanced plant propagation methods.

Unit 4: Horticulture Marketing and Business Procedures

_____1. Describe and apply marketing and business practices associated with horticulture operations.

Unit 5: Container and Field Crop Production

_____1. Describe and apply principles of container and field crop production.
_____2. Investigate and explore new and emerging technologies, practices, and issues associated with container and field grown nursery production.

Unit 6: Floriculture Crop Production

_____1. Describe and apply principles of floral crop production.

Unit 7: Landscape Design

_____1. Describe and apply principles of landscape design.

Unit 8: Landscape Installation and Construction

_____1. Describe and apply basic principles of landscape installation and construction.

Unit 9: Landscape Maintenance

_____1. Describe and apply principles of landscape maintenance.

Unit 10: Turfgrass Installation and Maintenance

_____1. Describe and apply principles of turfgrass installation.
_____2. Describe and apply principles of turfgrass maintenance.
_____3. Demonstrate safe and proper maintenance of turf equipment.

Unit 11: Pomology Production

_____1. Describe and apply principles of fruit and berry production.

Unit 12: Advanced Floral Design

_____1. Review and reinforce principles of floristry.

Appendix A: Proposed Standards for Mississippi Agriculture Education Programs[1]

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. Each standard represents a pathway knowledge and skill statement as listed in this document. Standards are clustered by career pathway. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEADERSHIP (LEA)

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives.

a. Embrace empowerment, risk, communication, focusing on results, decision-making, problem-solving, investment in individuals, and resource use and access to develop premier leadership.
b. Embrace compassion, service, listening, coaching, developing others, team development, and understanding and appreciating others to develop premier leadership.
c. Embrace enthusiasm, creativity, the future, conviction, mission, courage, concept, focus, principles, and change to develop premier leadership.
d. Embrace integrity, courage, values, ethics, humility, perseverance, self-discipline, and responsibility to develop premier leadership.
e. Include self, community, diversity, environment, global awareness, and knowledge to develop premier leadership.
f. Embrace innovation, intuition, adaptation, life-long learning, and coachability to develop premier leadership.

LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.

a. Embrace attitude, exercise, goal-setting, planning, self-discipline, sense of balance, persistence, and respect to develop personal growth.
b. Embrace friendship, integrity, morals, values, etiquette, citizenship, cross-cultural awareness, acceptance/change, and respect for differences to develop personal growth.
c. Embrace goal setting, planning, decision-making, principles, respect, attitude, dependability, loyalty, trustworthiness, and communication to develop personal growth.
d. Embrace learning, critical thinking, reasoning, creative thinking, attitude, dependability, decision-making, and problem-solving to develop personal growth.
e. Embrace attitude, self-discovery, coping, friendship, self-reliance, sense of balance, empathy, compassion, and integrity to develop personal growth.

[1] *Career cluster resources for agriculture, food, and natural resources*. (n.d.). Retrieved October 20, 2004, from http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

f. Embrace ethics, coping, courage, attitude, self-image/worth, values, principles, and sense of balance to develop personal growth.

ETHICS AND LEGAL RESPONSIBILITIES (ELR)

ELR1 Know and understand the importance of professional ethics and legal responsibilities.
- a. Apply knowledge of professional and workplace ethics and legal responsibilities to organize guidelines for workplace conduct.
- b. Apply ethical and legal reasoning to workplace situations.
- c. Review appropriate resources to identify national and international rules associated with a desired career.
- d. Identify what ethical issues and concerns affect a desired career field to assist in making career decisions.

ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
- a. Evidence interest and concern to demonstrate natural resource stewardship and ethics.
- b. Exercise personal habits and actions to demonstrate workplace ethics.

FOOD PRODUCTS AND PROCESSING SYSTEMS (FPP)

FPP1 Apply principles of food processing to maintain equipment and facilities.
- a. Develop management plans to maintain equipment and facilities.
- b. Interpret and follow, develop, and implement Hazardous Critical Control Point (HACCP) procedures to establish operating parameters.

FPP2 Apply principles of food science to the food industry.
- a. Apply food science principles to enhance product development.

FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
- a. Analyze product preparation options to prepare products for distribution.
- b. Compare and select food preservation methods to develop food preservation programs.

FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
- a. Develop a “quality factors program” to comply with local, national, and governmental, and international standards.
- b. Develop slaughter/inspection techniques to process foods and analyze food product options.

PLANT SYSTEMS (PLT)

PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
- a. Analyze and evaluate nutritional requirements and environmental conditions to develop and implement a fertilization plan.

b. Test appropriate materials or examine data to evaluate and manage soil/media nutrients.
c. Explain and use basic methods for reproducing and propagating plants.
d. Develop and use a plan for integrated pest management.

PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
a. Examine unique plant properties to identify/describe functional differences in plant structures including roots, stems, flowers, leaves, and fruit.
b. Classify plants on physiology for taxonomic or other classifications.

PLT3 Apply fundamentals of production and harvesting to produce plants.
a. Apply fundamentals of plant management to develop a production plan.
b. Apply fundamentals of plant management to harvest, handle, and store crops.

PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
a. Apply basic design elements and principles to create a design using plants.

ANIMAL SYSTEMS (ANM)

ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
a. Use classification systems to explain basic functions of animal anatomy and physiology.
b. Recognize the anatomy of animal species to understand how the body structures interact and affect animal health.
c. Analyze a subject animal to determine the nature of its health status.

ANM2 Recognize animal behaviors to facilitate working with animals safely.
a. Develop a safety plan for working with a specific animal.

ANM3 Provide proper nutrition to maintain animal performance.
a. Examine animal developmental stages to comprehend why nutrient requirements are different throughout an animal's life cycle.
b. Analyze a feed ration to determine whether or not it fulfills a given animal's nutrient requirements.
c. Record and compare feed variations to assess whether the nutritional requirements of an animal are being met.

ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
a. Analyze elements in the reproductive cycle to explain differences in the male and female reproductive systems.
b. Discuss reproductive cycles to show how they differ from species to species.
c. Evaluate an animal to determine its breeding soundness.

ANM5 Identify environmental factors that affect an animal's performance.
a. Recognize optimum performance for a given animal species.
b. Create a program to develop an animal to its highest potential performance.
c. Assess an animal to determine if it has reached its optimum performance level.
d. Develop efficient procedures to produce consistently high-quality animals, well-suited for their intended purposes.

TOOLS, EQUIPMENT, TECHNOLOGY, AND SAFETY (TET)

TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
- a. Select the appropriate tool to perform a given task.
- b. Keep tools in good working order for efficient work use.
- c. Wear protective equipment and handle natural resource tools and equipment with skill to demonstrate safe use of tools and equipment.

POWER SYSTEMS (PWR)

PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Relate power generation to energy sources.
- b. Apply principles of lubricants to sort and classify lubricants.

PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Perform scheduled service routines to maintain machinery and equipment.
- b. Observe rules of the road to operate machinery and equipment.

PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Troubleshoot problems and evaluate performance to service and repair components of internal combustion engines.
- b. Follow manufacturer's guidelines to service and repair power transmission systems.
- c. Evaluate performance and check maintenance manuals to service and repair hydraulic lines.
- d. Troubleshoot from schematics to service vehicle electrical systems.
- e. Use company diagrams and scenarios to service vehicle heating and air conditioning systems.
- f. Check performance parameters to service and repair steering, suspension, traction, and vehicle performance systems.
- g. Use tools in the workplace to demonstrate safe and proper skills with construction/fabrication hand tools.

STRUCTURAL SYSTEMS (STR)

STR1 Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
- a. Use computer skills to develop simple sketches and plans.

STR2 Read and relate structural plans to specifications and building codes.
- a. Examine blueprints and local codes to develop a logical construction plan.

STR3 Examine structural requirements to estimate project costs.
- a. Use bids and billing information to develop a complete materials list and project cost estimate.

STR4 Develop skills required to use construction/fabrication equipment and tools.

a. Use tools in the workplace to demonstrate safe and proper skills with construction/fabrication hand tools.

STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.

a. Design machinery and equipment including vehicles, implements, buildings, and facilities (e.g., feeding, feed storage).
b. Follow architectural and mechanical plans to construct buildings and facilities.

TECHNICAL SYSTEMS (TEC)

TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

a. Identify and explain the various types of hardware systems to show their applications and potentials.

TEC2 Use available power sources to plan and apply control systems.

a. Measure with selective instruments to demonstrate knowledge of basic electricity.
b. Reference electrical drawings to design, install, and troubleshoot control systems.

TEC3 Explain geospatial technology to demonstrate its applications.

a. Employ appropriate techniques to demonstrate application of GPS/GIS systems principles.
b. Use computer applications to produce maps that reflect surveying and mapping principles.
c. Select an area of personal expertise to demonstrate knowledge of end applications.

NATURAL RESOURCE SYSTEMS (NRS)

NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.

a. Identify resource management components to establish relationships in natural resource systems.
b. Apply cartographic skills to natural resource activities.
c. Monitor natural resource status to obtain planning data.
d. Employ environmental and wildlife knowledge to demonstrate natural resource enhancement techniques.
e. Examine weather and other criteria to recognize dangers related to work in an outdoor environment.
f. Learn applicable rules or laws to demonstrate natural resource mitigation techniques.

NRS2 Use effective venues to communicate natural phenomena to the public.

a. Communicate natural resources information to the general public.
b. Personally interpret natural resource phenomena to natural resource users.

NRS3 Apply scientific principles to natural resource management activities.

a. Use science concepts, processes, and research techniques to examine natural resource topics.

b. Examine biological and physical characteristics to identify and classify natural resources.
c. Examine natural cycles and related phenomena to describe ecologic concepts ad principles.

NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
a. Prepare presentations to describe how natural resource products are produced, harvested, processed, and used.

NRS5 Practice responsible conduct to protect natural resources.
a. Employ techniques and equipment needed to prevent wildfire.
b. Use wildfire suppression techniques to demonstrate abilities in firefighting and control.
c. Recognize symptoms of animal and plant diseases and use appropriate techniques to prevent their spread.
d. Recognize insect types and available controls to prevent insect infestation.
e. Use acceptable pesticides to treat insect infestation.
f. Know law enforcement procedures to manage public gatherings and to gain entry into secure, closed, or restricted areas.

ENVIRONMENTAL SERVICE SYSTEMS (ENV)

ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
a. Use instrumentation to monitor samples.
b. Calibrate and service instruments on a timely schedule to maintain environmental instrumentation.
c. Apply statistics, charts, and scattergrams to measure and monitor operations.

ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
a. Consult reliable resources or training to identify the major laws impacting environmental services.

ENV3 Apply scientific principles to environmental services.
a. Apply meteorological knowledge to recognize weather systems and weather patterns.
b. Describe soil composition and properties to demonstrate knowledge of soil science.
c. Explain well design and groundwater supplies to demonstrate knowledge of hydrology.
d. Discuss properties, classifications, and functions in order to understand wetland principles.
e. Discuss properties, classifications, and functions in order to understand watershed principles,
f. Use chemical analysis to conduct tests.
g. Apply sampling techniques and other assessments to demonstrate background knowledge of microbiology.

ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.

a. Use pollution control measures to maintain a safe facility environment.
b. Apply principles of solid waste management (landfill) to manage safe disposal of all categories of waste.
c. Apply drinking water treatment principles to assure safe drinking water at a facility.
d. Apply wastewater treatment operations principles to manage wastewater disposal in keeping with rules and regulations.
e. Apply hazardous materials management principles to assure a safe facility and to comply with applicable regulations.
f. Explore conventional and alternative supplies to define energy sources.

ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
a. Use technology tools to map land, facilities, and infrastructure.

AGRIBUSINESS SYSTEMS (ABS)

ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
a. Develop a mission statement to guide business activities effectively.
b. Apply leadership skills to accomplish general business activities from production to public relations.
c. Apply management skills to accomplish general business activities from production to public relations.

ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
a. Prepare and maintain all files as needed to accomplish effective recordkeeping.

ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
a. Use key accounting fundamentals to accomplish dependable bookkeeping and associated files.

ABS4 Employ AFNR industry concepts and practices to manage inventory.
a. Monitor inventory levels to accomplish practical inventory control.

ABS5 Utilize technology to accomplish AFNR business objectives.
a. Use technology and information technology strategies for business improvement.

ABS6 Use marketing and sales principles to accomplish an AFNR business objective.
a. Conduct market research.
b. Develop a marketing plan.
c. Implement a marketing plan.
d. Merchandise products and services.

Appendix B: Academic Standards

Algebra I[2]

Competencies and Suggested Objective(s)

A1 Recognize, classify, and use real numbers and their properties.
- a. Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
- b. Model properties and equivalence relationships of real numbers.
- c. Demonstrate and apply properties of real numbers to algebraic expressions.
- d. Perform basic operations on square roots excluding rationalizing denominators.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- a. Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
- b. Explain and illustrate how change in one variable may result in a change in another variable.
- c. Determine the rule that describes a pattern and determine the pattern given the rule.
- d. Apply patterns to graphs and use appropriate technology.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- a. Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
- b. Graph and check linear equations and inequalities in two variables.
- c. Solve and graph absolute value equations and inequalities in one variable.
- d. Use algebraic and graphical methods to solve systems of linear equations and inequalities.
- e. Translate problem-solving situations into algebraic sentences and determine solutions.

A4 Explore and communicate the characteristics and operations of polynomials.
- a. Classify polynomials and determine the degree.
- b. Add, subtract, multiply, and divide polynomial expressions.
- c. Factor polynomials using algebraic methods and geometric models.
- d. Investigate and apply real-number solutions to quadratic equations algebraically and graphically.
- e. Use convincing arguments to justify unfactorable polynomials.
- f. Apply polynomial operations to problems involving perimeter and area.

A5 Utilize various formulas in problem-solving situations.
- a. Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
- b. Reinforce formulas experimentally to verify solutions.
- c. Given a literal equation, solve for any variable of degree one.

[2] *Mississippi mathematics framework—Algebra I.* (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/mathematics/ma_algebra_i.html

d. Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
e. Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.

A6 Communicate using the language of algebra.
a. Recognize and demonstrate the appropriate use of terms, symbols, and notations.
b. Distinguish between linear and non-linear equations.
c. Translate between verbal expressions and algebraic expressions.
d. Apply the operations of addition, subtraction, and scalar multiplication to matrices.
e. Use scientific notation to solve problems.
f. Use appropriate algebraic language to justify solutions and processes used in solving problems.

A7 Interpret and apply slope as a rate of change.
a. Define slope as a rate of change using algebraic and geometric representations.
b. Interpret and apply slope as a rate of change in problem-solving situations.
c. Use ratio and proportion to solve problems including direct variation (y=kx).
d. Apply the concept of slope to parallel and perpendicular lines.

A8 Analyze data and apply concepts of probability.
a. Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
b. Define event and sample spaces and apply to simple probability problems.
c. Use counting techniques, permutations, and combinations to solve probability problems.

Biology I[3]

Competencies and Suggested Objective(s)

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
a. Demonstrate the proper use and care for scientific equipment used in biology.
b. Observe and practice safe procedures in the classroom and laboratory.
c. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
d. Communicate results of scientific investigations in oral, written, and graphic form.

B2 Investigate the biochemical basis of life.
a. Identify the characteristics of living things.
b. Describe and differentiate between covalent and ionic bonds using examples of each.
c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.
d. Classify solutions using the pH scale and relate the importance of pH to organism survival.

[3] *Mississippi science framework—Biology I.* (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/science/sci_biology_I.html

e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
f. Explain how enzymes work and identify factors that can affect enzyme action.

B3 Investigate cell structures, functions, and methods of reproduction.
a. Differentiate between prokaryotic and eukaryotic cells.
b. Distinguish between plant and animal (eukaryotic) cell structures.
c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
d. Describe the way in which cells are organized in multicellular organisms.
e. Relate cell membrane structure to its function in passive and active transport.
f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
h. Identify and distinguish among forms of asexual and sexual reproduction.

B4 Investigate the transfer of energy from the sun to living systems.
a. Describe the structure of ATP and its importance in life processes.
b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
c. Compare and contrast aerobic and anaerobic respiration.

B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).

B6 Investigate concepts of natural selection as they relate to diversity of life.
a. Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
b. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
c. Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
d. Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.
e. Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.

f. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.

B7 Investigate the interdependence and interactions that occur within an ecosystem.

a. Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
b. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
c. Compare variations, tolerances, and adaptations of plants and animals in major biomes.
d. Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
e. Examine long and short-term changes to the environment as a result of natural events and human actions.

English II[4]

Competencies and Suggested Objective(s)

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

a. Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
b. Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
c. Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
d. Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.

a. Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
b. Speak with appropriate intonation, articulation, gestures, and facial expression.
c. Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

a. Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.
b. Access both print and non-print sources to produce an I-Search paper, research paper, or project.

[4] *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/language_arts/la_10.html

c. Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
d. Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
a. Interact with peers to examine real world and literary issues and ideas.
b. Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
a. Share, critique, and evaluate works in progress and completed works through a process approach.
b. Communicate effectively in a group to present completed projects and/or compositions.
c. Edit oral and written presentations to reflect correct grammar, usage, and mechanics.

E6 Explore cultural contributions to the history of the English language and its literature.
a. Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
b. Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
c. Recognize root words, prefixes, suffixes, and cognates.
d. Relate how vocabulary and spelling have changed over time.

E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
a. Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.
b. Read aloud with fluency and expression.
c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
e. Analyze how grammatical structure or style helps to create a certain effect.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.
b. Read, discuss, and interpret literature to make connections to life.
c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.
d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.

e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- a. Infuse the study of grammar and vocabulary into written and oral communication.
- b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
- c. Give oral presentations to reinforce the use of standard English.
- d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.

E10 Use language and critical thinking strategies to serve as tools for learning.
- a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
- b. Interpret visual material orally and in writing.

U. S. History from 1877[5]

Competencies and Suggested Objective(s)

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
- a. Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
- b. Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women's Movement, Civil Rights Movement, the New Deal, etc.).
- c. Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
- d. Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).

H2 Describe the impact of science and technology on the historical development of the United States in the global community.
- a. Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
- b. Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).
- c. Describe the effects of transportation and communication advances since 1877.

H3 Describe the relationship of people, places, and environments through time.

[5] *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/social_studies/ss_us_history.html

a. Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).
b. Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).

H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
a. Interpret special purpose maps, primary/secondary sources, and political cartoons.
b. Analyze technological information on graphs, charts, and timelines.
c. Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).

H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.
a. Examine various reform movements (e.g., Civil Rights, Women's Movement, etc.).
b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).
c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).
d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

Appendix C: Workplace Skills for the 21st Century [6]

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

[6] *Secretary's commission on achieving necessary skills*. Retrieved July 13, 2004, from http://wdr.doleta.gov/SCANS/

Appendix D: National Educational Technology Standards for Students[7]

T1 Basic operations and concepts
- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

T2 Social, ethical, and human issues
- Students understand the ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

T3 Technology productivity tools
- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

T4 Technology communications tools
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

T5 Technology research tools
- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

T6 Technology problem-solving and decision-making tools
- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of strategies for solving problems in the real world.

[7] *ISTE: National educational technology standards (NETS).* Retrieved July 13, 2004, from http://cnets.iste.org/