COURSE NUMBER: Hort-203

COURSE TITLE: Horticultural Science

CREDIT HOURS: (4) four

INSTRUCTOR: Derek Dick

OFFICE LOCATION: 116 Weinberg Hall

OFFICE HOURS: As posted

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PREREQUISITES: None

REQUIRED TEXT: Hartman's Plant Science, McMahon, Koerdnek, Rubatsky

COURSE DESCRIPTION: Horticultural plant structure and function, effects of environmental factors on plant growth, and survey of the fruit, nut, vegetable, bedding plant, pot plant, cut flower, nursery and landscape industries. Horticultural crop families, growing systems and culture needs, soil preparation and fertilization, selecting and propagating varieties, preventing pests, regulating growth, harvesting, value-added processing and marketing.

EXPECTED LEARNER OUTCOMES: Upon completion of this course the student will be able to:

1. The student will gain an understanding of the development of horticultural crop production and plant science.
2. The student will understand the system used for classifying plants and demonstrate proficiency at using dichotomous plant identification keys.
3. The student will understand the organization of plant cells, tissues, systems and organs, and can recognize these structures under the microscope.
4. The student will gain an appreciation for the basic plant processes including photosynthesis, respiration, metabolism, nutrient absorption, translocation and transpiration.
5. The student will understand plant differentiation, vegetative and reproductive physiology, and life cycles, and will

demonstrate the effects of plant growth regulators on development of several types of plant organs.

6. The student will discover how plants reproduce and demonstrate several methods of propagating plants.
7. The student will discover the effects of several levels of light and temperature on growth of various types of plants.
8. The student will gain an understanding of world climate zones and the types of horticultural crops and cropping systems adapted to each zone.
9. The student will recognize the importance of soil management for crops, understand the mineral nutrition needs of plants, and recognize plant symptoms of mineral deficiency and excess.
10. The student will understand the basics of crop water management and how to design an irrigation system.
11. The student will understand the basics of plant pest management and con identify common insect pests, diseases, and weeds.
12. The student will gain an appreciation for the process of breeding plants to develop improved cultivars, and will select seedlings for disease resistance following pathogen inoculation.
13. The student will name examples of fruit, nut, vegetable, bedding plant, pot plant, cut flower, and landscape crops, and detail the basic cultural practices needed to produce these crops.

LEARNING TASKS & ACTIVITIES:

1. Horticultural Science will acquaint students with the classification, anatomy, growth, development, vegetative and reproductive physiology, propagation and culture of horticultural plants. Students will identify plant species using whole plant samples, flowers, fruits, seeds, and seedlings. Students will learn and experimentally demonstrate what effects various durations and intensities of light and temperature have on various types of plants.

2. Students will propagate plants by seed and vegetatively, study the effects of plant growth regulators on development of several plants, and study plant life cycles. Students will study cropping systems and management techniques for the various horticultural industries. They

will learn to identify common plant pests and nutrient deficiencies and learn the basics of soil, fertilizer, water, and pest management.

3. Two to three lectures per week will be presented on the topics detailed in the course outline, with time allowed for questions and discussion of the corresponding text sections. Students will experimentally demonstrate the principles discussed in lecture during the laboratory period each week, in the greenhouse or outdoor campus plantings and in the laboratory.

ASSESSMENT OF OUTCOMES:

Weekly quizzes, three tests and one comprehensive final examination will be used to assess each student's cognitive comprehension of lecture topics. Laboratory performance will be evaluated by the completion of all assignments on schedule and the participation of the student. The following points will be assigned to each evaluation:

Three one hour examinations	300
One final examination	100
Weekly quizzes	150
Laboratory	300
Total	850

The following scale will be used to determine final grades and is subject to change upon notification:

90%-100% = A
80%- 89% = B
70%- 79% = C
60%- 69% = D
59% and below =F

ATTENDANCE POLICY:

Attendance at all class meeting times is required. All laboratories will be held in the college greenhouse, and all assignments must be completed during the scheduled laboratory meeting time and all quizzes, tests and exams must be taken at scheduled times unless the student has an excused absence and makes arrangements with the instructor before the student missed the scheduled class. All cell phones or pagers must be turned of in the classroom or the student will be asked to leave.

LEARNING TASK AND ACTIVITIES:

Week 1: Introduction and Chapter 1
Lab: Poinsettia Production
Week 2: Chapter 2, Plant Structure
Lab: General overview of greenhouse, safety
Week 3: Chapter 3, Classification
Lab: Structure of plants and embryo
Week 4: Review, Test
Lab: Test groups in poinsettias, pinch, PGR's
Week 5: Chapter 5, Propagation, using PGR's
Lab: Asexual and Sexual propagation
Week 6: Chapter 4
Lab: Insect Pest ID
Week 7: Chapter 6, Plant development
Lab: Chemical, Fertilizer, and PGR applications
Week 8: Chapter 7, Photosynthesis, Respiration, and Translocation
Lab: Asexual and Sexual propagation
Week 9: Review, Test
Lab: Pot rooted cuttings, Observe poinsettia test
Week 10: Chapter 8, Soil
Lab: Photosensitive Trial
Week 11: Chapter 9 Soil and Water Management
Lab: Local greenhouse tour
Week 12: Chapter 10, 11
Lab: Hydroponics
Week 13: Review, Test
Lab: Floriculture
Week 14: Chapter 15, 16, 17
Lab: Pruning Techniques
Week 15: Chapter 19 Lawns and Turf Grasses
Lab: Set up Turf grass trials
Week 16: Review, Final
Lab: Finish Poinsettias, data

Horticultural Science Competencies

The student will gain an understanding of the development of horticultural crop production and plant science.

1. Explain how the crop plants we grow today were domesticated, selected and improved over hundreds to thousands of years.
2. Name the regions of origin for several important horticultural crop plants.
3. Define the plant science disciplines of agronomy, horticulture and forestry and describe how these divisions arose.
4. Describe the scientific method.
5. Define the “agricultural revolution” and “appropriate technology”.

The student will understand the system used for classifying plants and demonstrate proficiency at using dichotomous plant identification keys.

1. Explain the classification of plants into divisions, classes, subclasses, orders, families, genera and species, and the binomial system of nomenclature.
2. Correctly identify 10 horticulture plant species using dichotomous keys.
3. Classify plants according to their life span, structure and form, leaf retention, climatic adaptation, and use to people.
4. Define these plant classification terms: annual, biennial, perennial, herbaceous, woody, deciduous, evergreen, boreal, temperate, subtropical, tropical, hardy, tender, crops, forages, and ornamental.

The student will understand the organization of plant cells, tissues, systems and organs, and can recognize these structures under the microscope.

1. Identify the components of a plant cell.
2. Microscopically differentiate these plant cell parts: cell wall, vacuole, nucleous, cloroplasts, chromoplasts, leucoplatsts, mitochondria, and ribosomes. Name a primary function of each. Determine which two parts best distinguish plant from animal cells.
3. Differentiate between meristematic and permanent tissues in plants, and between simple and complex tissues.
4. List and describe the characteristics of four types of simple tissues and two types of complex tissues.
5. Observe the structure of roots and shoots of monocots and dicots under the microscope, and describe how they differ. Locate the epidermis, cortex, endodermis, pith, phloem, xylem, cambium, apical meristem, region of enlargement, region of maturation, and region of differentiation.
6. List major functions of stems and roots. Describe several types of specialized stems and roots and list a crop example of each.
7. Macroscopically differentiate several types of leaves, flowers, fruits and seeds.
8. Macroscopically differentiate monocots and dicots by their leaves, flowers, and seeds.

9. Microscopically observe these parts of a leaf: epidermis, guard cells, stomata, cuticle, palisade mesophyll, spongy mesophyll, and vascular bundles. Name a primary function of each part.
10. Locate these parts of a flower: receptacle, calyx, sepal, corolla, petal, stamen, filament, anther, carpel, stigma, style, ovary, perianth.

The student will gain an appreciation for the basic plant processes including photosynthesis, respiration, metabolism, nutrient absorption, translocation, and transpiration.

1. Diagram photosynthesis, including the two substances and the energy source used to produce the three products.
2. Differentiate between the two phases of photosynthesis, and explain why one phase requires light while the other does not.
3. Differentiate between the photosynthetic processes of C3 and C4 plants.
4. Diagram respiration, including the two substances utilized and the two substances plus energy produced.
5. Name several types of secondary plant metabolic substances, and name examples of crop plants cultivated for their unique metabolites.
6. Describe the process of nutrient absorption in plants.
7. Define translocation and transpiration in plants.

The student will understand plant differentiation, vegetative and reproductive physiology, and life cycles, and will demonstrate the effects of plant growth regulators on development of several types of plant organs.

1. Describe the process of cell differentiation of plants.
2. Define plant hormones and growth regulators. Name five groups of plant growth regulators and name an effect of each group on plant growth.
3. Differentiate between physical and physiological dormancy of seeds, and describe methods of overcoming each type of dormacy in order to hasten seed germination.
4. Define juvenility in plants and describe how it can be terminated.
5. Describe bud dormacy , the rest period, and the breaking of rest.
6. Assess the effects of light and temperature on flowering.
7. Describe how pollination stimulates fruit development.
8. Describe the effects of temperature on fruit ripening.

The student will discover how plants reproduce and demonstrate several methods of propagating plants.

1. Differentiate between asexual and sexual reproduction, and mitosis and meiosis.
2. Define the terms gene and chromosome, and tell where in the cell these are located.
3. State what the abbreviations DNA and RNA stand for. Describe the structure of these nucleic acids.
4. Explain how the information stored in DNA is used to produce proteins, and what these proteins do.

5. Name three advantages and two disadvantages of propagating plants by seed. Name two groups of plants commonly propagated by seed.
6. Describe seed scarification and stratification.
7. Demonstrate an efficient method of seed propagation which minimizes fungal infection. Demonstrate the effects of bottom heat on seed germination.
8. Name two advantages and two disadvantages of propagating plants vegetatively. Name four methods of vegetative propagation and a crop commonly propagated by each method.
9. Propagate plants by division, cuttings and grafting or layering. Demonstrate the effects of bottom heat and different concentrations of externally-applied auxins on root formation of cuttings.

The student will discover the effects of several levels of light and temperature on growth of various types of plants.

1. Demonstrate the effects of degree of light intensity on growth of plants adapted to sun and to shade. Name two plants adapted to full sun and two plants adapted to shade.
2. Assess ways of controlling light intensity in vegetable fields, orchards, nurseries, and greenhouses.
3. Describe the reactions to day length of long-day, short-day and day-neutral plants.
4. Describe the effects of increasing temperature on three plant processes: photosynthesis, respiration, and transpiration.
5. Analyze how minimum winter temperature, degree and rapidity of temperature decreases and increases, the number of winter chilling units and spring heat units, the length of the growing season, and maximum summer temperatures affect crop adaptation.
6. Describe four methods of moderating excessively cold or hot temperatures in crop production and landscapes.

The student will gain an understanding for world climate zones and the types of crops and cropping systems adapted to each zone.

1. Describe the climates typical of tropical rainforests, monsoon rainforests, tropical savannahs, deserts, steppes, dry-summer subtropical, humid subtropical, marine west coast, humid continental with warm or cool summers, and polar climates. Name a crop adapted to each climate type.
2. Explain how crops are bred for adaptation to different climate types.
3. Describe shifting agriculture, intercropping, plantation cropping, orcharding and tree cropping, flood-plain irrigation cropping, irrigated desert cropping, dryland farming, and agroforestry.
4. Categorize various climate-control structures such as greenhouses, polyethylene tunnels, shadehouses and refrigerated storage units as to the horticultural crops best suited to each and the expenses of each.

The student will recognize the importance of soil management for crops, understand the mineral nutrition needs of plants, and recognize plant symptoms of mineral deficiency and excess.

1. Name the three major classifications of soil mineral particles, and describe how the proportion of each in a soil influences the soil's water infiltration rates and water retention.
2. Describe the importance of soil organic matter content to crop production.
3. Define mycorrhiza, pathogenic soil fungi and saprophytic soil fungi.
4. Describe the U.S. land capability classification system.
5. Name three methods of minimizing soil erosion in crop production.
6. Define pH. Measure the pH of several soil samples. Describe how to regulate soil pH in crop fields.
7. Name the three major plant nutrients supplied by fertilizers. Explain fertilizer analysis.
8. Describe three methods of applying fertilizers.
9. Differentiate between nutrient deficiency, sufficiency, luxury consumption and excess.
10. Categorize the functions in plants of nitrogen, phosphorous, potassium, calcium, magnesium, iron and manganese.
11. Diagnose deficiency symptoms for each of these minerals.
12. Name two types of nitrogen-fixing organisms associated with certain plants.

The student will understand the basics of crop water management and how to design an irrigation system.

1. Determine soil moisture content by feel and using tensiometers.
2. Examine the leaf and root anatomy of hydrophytes, mesophytes, and xerophytes, and compare the adaptive differences of each.
3. Recognize plant symptoms of water deficiency or excess.
4. Name and describe four irrigation methods.
5. Describe two ways of determining irrigation needs.
6. Assess how well terraces, choices of crops, rotation cropping, ecofallow, weed control, mulches, and antitranspriants conserve water.
7. Describe methods of achieving good drainage in field and container crops.
8. Design a crop irrigation system.

The student will understand the basics of plant pest management and can identify common insect pests, diseases and weeds.

1. Name five types of microorganisms that can cause plant diseases.
2. Describe how the injury to crops caused by chewing insect pests differs from that caused by sucking insect pests.
3. Name three characteristics of weeds that make them aggressive competitors of crop plants.
4. Name five general methods of protecting crops from pests.
5. Diagnose six common insect pests, six plant diseases, and six weed pests of crops.
6. Describe integrated pest management.
7. Describe methods of reducing crop damage from fire, hail, and wind.
8. Diagnose symptoms of damage in plants from common air pollutants.

The student will gain an appreciation for the process of breeding plant to develop improved cultivars, and will select seedlings for disease resistance following pathogen inoculation.

1. Define genotype, phenotype, heritability, mutation, dominant gene, recessive gene, and hybrid vigor.
2. Describe how plant breeding methods differ for seed-propagated and vegetatively-propagated crops.
3. Demonstrate how to prepare pathogen inoculum, inoculate seedlings, maintain conditions conductive to infection and disease, and select seedlings for disease resistance in a breeding program.

The student will name examples of fruit, nut, vegetable, bedding plant, pot plant, cut flower, and landscape crops, and detail the basic cultural practices needed to produce these crops.

1. Name seven commercial fruit crops in the *Rosaceae*, including two pome fruits and three stone fruits.
2. Name three major nut crops and the climatic adaptations of each.
3. Name three commercial vegetable crops in the *Solanacae* and three in the *Cucurbitaceae*.
4. Differentiate the seeds and seedlings of common vegetable crops.
5. Recognize common bedding plant, pot plant, and cut flower crops in the greenhouse, and perform basic cultural practices needed to grow these.
6. Prune fruit trees and ornamental shrubs properly.
7. Recognize common ornamental trees and shrubs on campus, and demonstrate proper pruning of woody ornamental plants.