

## Horticulture

Active as of Fall Semester 2012

### I. General Information

1. Course Title:

Plant Science

2. Course Prefix & Number:

HORT 1104

3. Course Credits and Contact Hours:

**Credits:** 4

**Lecture Hours:** 4

4. Course Description:

This course is a survey of the biological considerations for growing and caring of plants. This class will cover plant characteristics, classification, and biology; soil considerations, components, uses, and characteristics; propagation types and strategies of woody and herbaceous plants.

5. Placement Tests Required:

**Accuplacer (specify test):** No placement tests required

6. Prerequisite Courses:

There are no prerequisites for this course.

9. Co-requisite Courses:

There are no corequisites for this course.

### II. Transfer and Articulation

3. Prior Learning - the following prior learning methods are acceptable for this course:

- Advanced Standing
- Written
- Portfolio

### III. Course Purpose

1. Program-Applicable Courses – This course is required for the following program(s):

Landscape Technology, Diploma

Sustainable Greenhouse, Diploma

Floral Design, Diploma

Horticulture, AAS

## IV. Learning Outcomes

### 1. College-Wide Outcomes

#### College-Wide Outcomes/Competencies

Demonstrate written communication skills

Analyze and follow a sequence of operations

Work as a team member to achieve shared goals

#### Students will be able to:

Create a personal resume

Assess nutrient deficiencies related to soil characteristics and recommend a plan of action.

Demonstrate interpersonal relations to work within a group to create a poster board presentation on a current horticultural trend or topic.

2. Course Specific Outcomes - Students will be able to achieve the following measurable goals upon completion of the course:

<i>Expected Outcome</i>	<i>MnTC Goal Area</i>
Describe the distinctions between the taxonomy of plants from kingdom to cultivar Describe biological plant structures of flowers, stems, fruit, seeds, leaves, roots Differentiate above listed plant structures in relation to differences in species and genera	
Compare and contrast biological processes related to gymnosperms and angiosperms Characterize physiological processes related to photosynthesis, respiration and transpiration Define and classify xylem, phloem, and vascular cambium in relation to their place between monocots and dicots	
Identify greenhouse media by appearance Compare and contrast greenhouse media by their water absorption, compaction, and organic vs. non organic characteristics Assess proper propagation techniques in relation to plant structure both in the wild and in cultivation	
Interpret fertilizer analysis of different fertilizer formulations Determine fertilizer nutrient composition by weight of components Determine soil texture when given percentages of soil separates	
Compare and contrast differences between softwood, semi hardwood, hardwood and cane cuttings in relation to timing and differences in stem tissue structure Support reasoning behind methods to break physical and physiological dormancy of seeds Explain connections between seed source and plant hardiness traits	
Create a personal professional resume	

## V. Topical Outline

Listed below are major areas of content typically covered in this course.

### 1. Lecture Sessions

#### I. Green Plants

- Divisions of Horticulture
  - Arboriculture to Pomology
  - Ornamental crops to food crops
- Plant Classification
  - Kingdom to Species
    - Cultivar, variety, hybrid
    - Gymnosperm vs. angiosperm
    - Nomenclature

Linnaeus /Marshal

Structural /Physiological characteristics

- Plant Parts

- Stems
  - Function and form

Vascular bundle scar ID and physiological purpose

Node and internode ID function in growth

Lenticel ID and gas exchange function

Bud ID & function relation to flowers and leaves

- Adventitious, terminal, pseudoterminal, axillary
- Woody vs. herbaceous

Meristematic tissue

Xylem, phloem, vascular cambium physiological function and organization

Monocot vs. dicot

- Modified stems

Rhizome, stolens, tubers, corms, bulbs, crowns, spurs

- Identification
- Propagation considerations
- Roots

Root hair cellular make up

Adventitious roots

Apical meristems

Root cap function and form

Leaves

Function and form

Simple vs. compound

Palmate, pinnate, bi-pinnate

Margin, base and apex variety

Epidermis function and make up

Flowers

Hypogynous, perigyonus, epigynous

Ovary position

Petal/sepal relation

- Single, inflorescence, disk type structure and form
  - Relation to production and organization of fruit
  - Organization and form related to ID

Spike, raceme, panicle, catkin, cyme, corymb, umbel

Pistal and stamen make up and function

Fruit

- Exocarp, mesocarp, endocarp

Function in fruit composition and identification

- Fleshy vs. dry
- Dehiscent vs. indehiscent
- Simple, multiple, aggregate type organization and form
  - Drupe, pome, berry, hesperidium
  - Legume, capsule, achene, nut, nutlet, samara
    - Juvenility vs. maturity
    - Plant Processes
      - Photosynthesis
        - Chemical formula
        - Relation to CO<sub>2</sub>, H<sub>2</sub>O, and sun light concentrations
        - Natural vs. manmade energy source
        - Transpiration

Leaf stomata

Relation to relative humidity

Guttation

Respiration

- Chemical formula
- Relationship to photosynthesis

- Growth Potential
- Relationship to genetics
- Relationship to environmental factors

## Soil

- Nutrition, air ratio, moisture ratio
- Atmosphere

CO<sub>2</sub> levels, O<sub>2</sub> levels, atmospheric pollutants, humidity

Water

Photosynthesis needs, control on transpiration

Light

Chlorophyll needs

Phototropism

Short day, long day, day neutral

Temperature

Control on germination, transpiration, respiration, flowering

Cool season vs. warm season crops

Air vs. ground temperatures

Hardiness Zone Map

Temperature zone break down

Most recent update (2012 using 1976-2005 averages)

Other factors not included

## 2. Describing and Identifying Plants

- Woody vs. herbaceous
- Evergreen vs. deciduous vs. semi-evergreen
  - Needle vs. broadleaf
  - Relationship to hardiness zone
- Trees, shrubs, vines, ground cover
  - Height, stem count, growth habit
- Annuals, perennials, biennials
  - Annual in zone 3 but perennial in zone 7?
  - Cost differences
  - Time to maturity
- Hardy vs. tender
  - Temperatures, moisture levels, sunlight needs
- Bedding plants, foliage plants
  - Origin of indoor plants
- Native, exotic, and naturalized plants
  - Can you predict the next noxious weeds?

## 3. The Soil

- Definition
  - Natural soil vs. greenhouse/nursery medium
  - How soils differ
    - Texture
    - Soil deposition
    - Weathering

Temperatures, water movement, root growth action

Soil separates

- Sand, silt, clay
- Size, shape, water holding capacity, air ratios, surface area, chemical activity, nutrition
- Soil texture

Soil triangle

Field use

Loam

Soil nutrition

## Essential Elements

### Macro nutrients

Calcium, carbon hydrogen, magnesium, nitrogen oxygen, phosphorous, potassium, sulfur

Functions in plants, symptoms of deficiency

- Micronutrients

Boron, chorine, copper, iron, manganese, molybdenum, zinc, nickel

Functions in plants, symptoms of deficiency

- Leeching
- Soil structure
  - Aggregates
  - Sand, silt, clay considerations
  - Soil pH

### Soil solution

Acid, neutral, alkaline

- H<sup>+</sup> ions, OH<sup>-</sup> ions
- Optimum range for growth
- Measuring and controlling
- Relationship to mineral absorption
- Relationship to cation exchange capacity
- Buffering capacity
  - Elemental sulfur, organic matter, limestone
  - Cation Exchange capacity

Cations, anions, colloidal particles

Weathering

Clay and organic matter

### Fertilizers

- Commercial vs. organic
- Complete vs. incomplete
- Fillers
- Trade secrets, micro nutrients, pH additives
- Analysis
  - High vs. low analysis
  - NPK

% by weight

### Nitrogen

- Function, formation, fixation, nitrate salts, ammonium salts, nitrifying bacteria
- Phosphorus

Function, formation, relation to aquatic systems, limiting nutrient

### Potassium

Function, formation

#### 4. Plant Growth Regulators

- What are they?
  - Auxin
  - Cytokinin
  - Gibberellins
  - Parthenocarp, phototropism, geotropism
  - Types of regulators
    - Growth promoters
    - Growth inhibitors
    - Rooting hormones
    - Powder vs. liquid

Quick dip vs. soak

Pre-dips

Commercial growth regulators vs. natural

#### 5. Plant Reproduction

- Sexual vs. asexual reproduction
  - Genetics
  - Plant patents
  - Natural vs. cultivated
  - Plant improvement
    - Genetic variation
    - Hybridization
    - Cultivation
    - Natural variety

Provenance

Mutations

- Natural vs. forced
6. Plant Propagation
- Media for propagation
    - Perlite, vermiculite, peat, sand, rockwool, compost, coir, charcoal
    - Seeds
      - Embryo

Axes

Monocot vs. dicot

Radicle, plumule, cotyledons

- Storage tissue
  - Endosperm, cotyledon storage
  - Oil, starch, protein
  - Seed coat
    - Embryonic protection
    - Gas exchange
    - Imbibitions
    - Viability
    - Periodicity
    - Dormancy
      - Physical dormancy

Hard and waxy seed coats

Scarification

- Mechanical, acid, soak
- Physiological dormancy
  - Immature embryo, chemical imbalance

Warm moist stratification

Cool moist stratification

- Double dormancy
- Deep dormancy
- Epicotyl dormancy
- Division

Growth habit

Suckering, fibrous root systems

- Timing
- Modified stems
  - Bulblets, bulbils, scales, cormels
  - Cuttings

Rooting hormones

Root cuttings

- Length and diameter needs

Nutrition reserves

Shoot primordial

- Stem cuttings
  - Stem length and bud numbers and types
  - Herbaceous

Non woody perennials, house plants

Woody

- Softwood, semi-hardwood, hardwood
- Cane cuttings
- Leaf cuttings
  - Meristematic tissue
  - Veins severed, blade cutting, whole leaf (petiole considerations), leaf bud, leaf section
  - Grafting

Root stock vs. scion wood

Success vs. failure

- Compatibility
- Cambial contact
- Physical closeness of fit
- Dicot vs. monocot
- Graft rejection
- Fragility of union
- Loss to girdling
- Reasons
  - Size and shape control
  - Plant vigor
  - Multiple varieties on single plant
  - Fruit bearing age
  - Adaptations to soil conditions
  - Production
  - Repairing damage
  - Types
    - Double graft
    - Splice
    - Whip and tongue
    - Saddle and inverted saddle
    - Bark graft
    - Veneer graft
    - Cleft graft
    - Budding

Budwood

- Collection
- Compatibility
- Flower vs. leaf buds
- Types
  - T bud and inverted T bud
  - I bud
  - Patch bud
  - Layering

Natural

Tip layering

Serpentine

Stooling

Air layering

Tissue Culture

- Success and failure
- Aseptic conditions
- Facilities and costs
- Controlled environmental conditions
- Explants
  - Size and numbers
  - Tissue differentiation

- Agar mix