



Course Syllabus

BIOL 1411 - General Botany

Catalog Description: Biol1411 offers a study of the following principles and concepts as defined in The *Academic Course Manual Guide (ACGM)* for the State of Texas: "Study of structure and function of plant cells, tissues, and organs. Includes an evolutionary survey and life histories of the following representative groups: algae, fungi, mosses, liverworts, ferns, and seed producing organisms. Plant reproductive and functional interactions with their environment and with humans." (Lab fee)
(26.0301.51 03) **Lecture hours = 3, Lab hours = 1**

Prerequisites: None

Semester Credit Hours: 4

Lecture Hours per Week: 3 **Lab Hours per Week:** 3

Contact Hours per Semester: 96

State Approval Code: 26.0301.51 03

Course Subject/Catalog Number: BIOL 1411

Course Title: General Botany

Course Curriculum: State Criteria (those marked with an X reflect the state-mandated competencies taught in this course) (*double-click on the box and choose 'checked' or 'not-checked'*)

Basic Intellectual Competencies in the Core Curriculum

- Reading
- Writing
- Speaking
- Listening
- Critical thinking
- Computer literacy

Perspectives in the Core Curriculum

- Establish broad and multiple perspectives on the individual in relationship to the larger society and world in which he/she lives, and to understand the responsibilities of living in a culturally and ethnically diversified world.
- Stimulate a capacity to discuss and reflect upon individual, political, economic, and social aspects of life in order to understand ways in which to be a responsible member of society.
- Recognize the importance of maintaining health and wellness.
- Develop a capacity to use knowledge of how technology and science affect their lives.
- Develop personal values for ethical behavior.
- Develop the ability to make aesthetic judgments.
- Use logical reasoning in problem solving.
- Integrate knowledge and understand the interrelationships of the scholarly disciplines.

Mathematics

The objective of the mathematics component of the core curriculum is to develop a quantitatively literate college graduate. Every college graduate should be able to apply basic mathematical tools in the solution

of real-world problems.

- To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real-world situations.
- To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically.
- To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments.
- To use appropriate technology to enhance mathematical thinking and understanding and to solve mathematical problems and judge the reasonableness of the results.
- To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences from them.
- To recognize the limitations of mathematical and statistical models.
- To develop the view that mathematics is an evolving discipline, interrelated with human culture, and understand its connections to other disciplines.

Natural Sciences

The objective of the study of a natural sciences component of a core curriculum is to enable the student to understand, construct, and evaluate relationships in the natural sciences, and to enable the student to understand the bases for building and testing theories.

- To understand and apply method and appropriate technology to the study of natural sciences.
- To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
- To identify and recognize the differences among competing scientific theories.
- To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
- To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.

Instructional Goals and Purposes: To provide instruction in an atmosphere of mutual respect where students may develop their intellect and skills. To contribute to the development of students as responsible and informed members of society. To provide courses for students wishing to complete certificate programs, associate degree programs or wishing to transfer to a baccalaureate program

General Course Objectives:

1. To help prepare students who wish to pursue upper division coursework in biology or biology-related fields.
2. To help students develop an appreciation for the history and development of science.
3. To help students become better informed citizens by providing opportunities to learn the differences between science as a way of knowing and other disciplines such as art, philosophy and religion
4. To provide students an opportunity to understand and appreciate the complexity and relationships of living systems.
5. To help students become better informed regarding the role of plants in the environment and the use of plants by humans.
6. To make students aware of changing technologies in science and the responsibilities and ethical decisions that comes with the use of various technologies.
7. To help students become better informed regarding environmental issues.

Specific Course Objectives:

Unit 1: Importance of Plant Study, the Nature of Life

The History, Development and Importance of Plant Study

1. list ways in which plants are important to the "fabric of life".

- list the ways in which plants currently impact everyday life and how they might do so in the future.
- briefly explain what the scientific method is and what hypotheses are.
- name and or identify a contribution to the development of botany as a science made by each of the following: Theophrastus, Hooke, Janssen, Faber of Bamberg, Leeuwenhoek, Malpighi, Grew, van Helmont, Linnaeus, Schleidan, Shen Nung and Aristotle the Stagirite are and what there contribution to plant study involved.
- identify the authors of and explain the significance of the *Pun-tsao*, *History of Plants*, *Causes of Plants*, *Historia Naturalis*, *Materia Medica*, *Doctrine of Signatures*, herbals, *Species Plantarum*, *Origin of Species*, *Flora Antarctica*, and *Silent Spring*.
- list the major botanical disciplines and briefly indicate the particular aspect of botany with which each is concerned.

The Nature of Life

- discuss the difficulty in defining life
- identify and briefly explain and/or define the characteristics of life
- define matter and describe its basic state; describe the characteristics of matter
- identify some basic bonds between atoms
- explain the significance of valence
- define various types of ions
- distinguish molecules, compounds, mixtures
- describe acids, bases, and salts and briefly explain the meaning of the pH scale
- identify the various forms of energy
- identify the elements and the proportions in which they are found in cytoplasm
- identify the essential elements used as building blocks in plants. (P. 166 - 167)
- differentiate between micronutrients and macronutrients for plants (p. 166 - 167)
- identify and describe by form and function the 4 major groups of macromolecules (organic compounds)found in living systems

Unit 2: Water in Plants; Metabolism

Water in Plants

- in simple terms, explain diffusion, osmosis, turgor, imbibition, and active transport
- discus the pressure-flow hypothesis and the cohesion-tension theory
- know the pathway, movement, and utilization of water in plants
- explain the regulation of transpiration
- explain how a stoma opens and closes
- list some adaptive modifications of leaves and their surfaces relative to the regulation of transpiration

Metabolism in Plants

- contrast the generalized equations of photosynthesis and respiration
- describe the significance in photosynthesis of various parts of the visible light spectrum
- describe the significance of the various types of chlorophyll and the types of light they absorb and reflect
- describe the significance of the carotenoids and phycobilins
- explain the events, locations and principal products in the lights and dark reactions of photosynthesis
- explain the events, locations and principal products in glycolysis, pyruvic acid conversion, the Krebs cycle, and the lectron transport chain of respiration
- distinguish between aerobic respiration and fermentation

8. identify the events photosynthesis, aerobic respiration and anaerobic respiration in which ATP is created and/or used.
9. compare assimilation and digestion

Unit 3: Growth, Meiosis and Alternation of Generations

Growth

1. distinguish between growth, differentiation, development
2. distinguish between enzymes, hormones, and vitamins in form, function, origin
3. identify the types of plant hormones, and describe the major functions of each
4. discuss the commercial applications for the various types of plant hormones
5. compare and contrast the various types of plant movements
6. explain the forces behind the various types of plant movements
7. explain photoperiodism and distinguish between short-day, long-day, intermediate-day, and day-neutral plants
8. explain what phytochrome is and how it functions
9. describe the importance of florigen
10. discuss the role of temperature in plant growth
11. explain dormancy and stratification giving examples of each

Meiosis and Alternation of Generations

1. distinguish between sexual and asexual reproduction
2. name the phases of meiosis and describe the important events in each
3. compare and contrast meiosis and mitosis
4. explain the significance of crossing-over
5. indicate the points in the alternation of generations where the following occurs: a change from n to $2n$; a change from $2n$ to n ; initiation of the gametophyte generation
6. relate meiosis and alternation of generations to the process of DNA replication

Unit 4: Genetic, Plant Breeding and Propagation

Genetics

1. explain Mendel's selection of peas for genetic experiments
2. explain the significance of Mendel's experiments with peas
3. define allele, dominance, phenotype, genotype, homozygous, heterozygous, monohybrid cross, dihybrid cross, backcross, linkage, chromosomal mapping, and the Hardy-Weinberg law
4. differentiate between genotype and phenotype
5. list the genotypes of possible gametes produced by parents of a particular genotype
6. give the phenotypic and genotypic ratios of the first two generations in monohybrid cross and a dihybrid cross
7. demonstrate the use of Punnett squares and the Product Rule (solve simple genetic problems)
8. explain the different types of gene interactions
9. describe the kinds of RNA and their respective functions
10. compare and contrast replication, transcription, translation
11. compare and contrast the role of DNA and RNA in heredity and protein synthesis

Plant Breeding and Propagation

1. explain the functions of enzymes involved in the development of recombinant DNA
2. describe several applications of genetic engineering
3. explain the roles of hybridization, polyploidy and mutations in traditional plant breeding
4. explain the positive and negative aspects of the "Green Revolution:

5. explain tissue culture, mericlone, and related techniques
6. list some recent developments in plant biotechnology

Unit 5: Evolution

Evolution

1. explain how introgressive hybridization may lead to the development of new species
2. describe the contributions of Charles Darwin to theories of organic evolution and the tenets of natural selection as he understood them
3. explain the significance of mutation and reproductive isolation to evolution
4. list reasons, past and present, for the controversy over evolutionary theory

Unit 6: Flowering Plants and Civilization; Ecology; Biomes

Flowering Plants and Civilization

1. Give reasons for basing scientific evaluation on more than a single sampling.
2. List the major regions of distribution of cultivated plants and identify several plants from each region
3. List the characteristics of 10 flowering plant families
4. Identify which families have flowers with many separate parts and superior ovaries
5. Know five useful plants in the Laurel, Rose, Legume, and Spurge Families
6. Identify medicinal plants in the Poppy and Nightshade Families.
7. Construct a simple, original key to five flowering plant families.

Ecology

1. List at least 10 ways in which humans have disrupted ecosystems.
2. List the functions of producers, primary consumers, secondary consumers, and decomposers in an ecosystem.
3. Describe energy flow through an ecosystem.
4. Describe how nitrogen and carbon are cycled.
5. Define succession and describe a succession that begins with bare rocks and one that begins with water.
6. Define ecotype, secondary succession, eutrophication, and climax vegetation.
7. Describe an environmental problem in your "immediate" area and provide documentation (news articles, government postings, etc) of that problem.

Biomes

1. List the major biomes of North America and describe the characteristics and principal living members of each.
2. Select a biome in North America and locate another biome of the same type on another continent.

Laboratory Objectives

Microscopy and Lab Safety

1. identify the parts of the compound microscope
2. describe the function of the parts of the compound microscope
3. calculate the magnification of various lens combinations
4. define *resolution, field, and depth of field*
5. trace the path of light through the compound microscope

The Cell

1. distinguish the components of living or preserved cells with a light microscope
2. compare and contrast prokaryotic and eukaryotic cells

3. characterize parts of eukaryotic cells according to their structure and function
4. explain the difference between *cyclosis* and independent movement of microscopic objects

Mitosis

1. describe the cell cycle
2. list the phases of mitosis in sequence
3. describe the “big events” for each phase of mitosis
4. explain the significance of mitosis to a living organism
5. explain the nature, structure or function of *spindle fibers, poles, equator, homologues, chromatids, chromatin, DNA, chromosomes, centromeres, kinetochore, cell plate, phragmoplast, root cap, meristematic region (apical meristem), region of elongation.*

Meiosis and Alternation of Generations

1. list in sequence the phases of meiosis and describe the big events in each
2. demonstrate the phases of meiosis in a concrete model (pipe cleaners, clay)
3. explain or recognize where gametophyte and sporophyte phases of the life
4. cycles of plants begin and end.
5. identify tissues and structures as haploid or diploid
6. compare meiosis and mitosis

Genetics

1. define F_1 , F_2 , *genotype, phenotype, homozygous, heterozygous,*
2. *dominant, recessive, gene, and hybrid*
3. demonstrate the ability to calculate probability
4. diagram *monhybrid* and *dihybrid crosses*
5. explain the effects of recessive and dominant genes

Water in Plants

1. explain how water passes through a living plant
2. explain the role of transpiration in the movement of water
3. explain the nature of guttation
4. summarize the process of cellular respiration and the by-products of the process

Photosynthesis

1. define *photosynthesis*
2. using appropriate form, write a scientific report of the experiment
3. used to demonstrate the correlation between the presence of starch
4. and photosynthetic activity in a *Coleus* leaf
5. list the sequence in which plant pigments separate on chromatography paper

Cell Components and Products

1. explain/identify tests for the presence of starch, sugar, protein and be able to
2. use the tests to determine the presence or absence of these substances in
3. unknown solutions
4. identify a simple test for the presence of fats or oils
5. identify a simple technique for removing oils from leaves

Diffusion, Growth and Hormones

1. explain what *Brownian movement* is and why it occurs

2. explain *diffusion, osmosis, dialysis, and plasmolysis*
3. explain *transpiration* and *turgor movements*
4. explain how *auxin* and *gibberellin* affect stem growth
5. explain what *tropisms* are and why they occur
6. explain *etiolation*
7. explain the effect of *ethylene* on leaf abscission

Roots, Tissues

1. match descriptions of plant tissues with the appropriate names and categories
2. explain the difference between root hairs and lateral roots
3. identify the locations and functions of root tissues such as *epidermis, cortex,*
4. *Endodermis, pericycle, phloem, and xylem*
5. identify the various regions of a root
6. identify the location and composition of *Casparian strips*
7. compare dicot and monocot roots

Stems

1. recognize the externally visible parts of a woody twig in winter condition
2. and describe their derivations or functions
3. in a young alfalfa stem, recognize the locations and describe the functions
4. of *epidermis, cortex, primary phloem, primary xylem, and pith*
5. explain the differences and similarities between herbaceous and woody
6. dicot stems
7. compare dicot and monocot stems
8. in a woody dicot stem, locate and identify the following: *cork, cork cambium,*
9. *phelloderm, cortex, primary phloem, secondary phloem, vascular cambium,*
10. *secondary xylem, primary xylem, broad phloem ray, narrow phloem ray,*
11. *broad xylem ray, narrow xylem ray, fibers, tracheids, vessels, annual ring*
12. *of xylem, and pith*

Leaves

1. compare *simple* and *compound leaves*
2. know the parts of a complete leaf
3. compare *upper epidermis* and *lower epidermis*
4. identify *guard cells*, compare them to other cells, and describe their function
5. locate *veins (vascular bundles), palisade mesophyll, spongy mesophyll, stomata*
6. describe the functions of various leaf cells and tissues
7. compare a pine leaf and a dicot leaf with respect to form and composition of tissues
8. cells
9. compare dicot and monocot leaves

Kingdom Survey, Plant Names and Classification

1. in descending order, list the 7 major taxa developed by Linnaeus
2. Explain why the following kingdoms might be studied in a beginning botany course: Archaea, Eubacteria, Protocista, Fungi, Plantae
3. describe several problems associated with the application of common names to organisms; provide examples with which you are familiar
4. describe Binomial System of Nomenclature, how it developed and how it is currently used
5. explain the bases for a 3-domain, 6-kingdom taxonomic system.

Kingdoms Archaea, Eubacteria, Protocista

1. explain the significance of *gram positive* and *gram negative* in the
2. identification of bacteria
3. contrast bacterial cells with those of the Kingdom Protocista
4. explain the difference between *heterocysts* and *akinetes*
5. compare *Ulothrix*, *Spirogyra*, and *Oedogonium* with respect to
6. reproduction and chloroplasts
7. explain how a *diatom* is constructed and how it moves
8. identify the parts and structure of a *dinoflagellate* and of a *kelp* or other
9. large seaweed
10. explain how a slime mold *plasmodium* moves and the structure of slime
11. mold sporangia

Kingdom Fungi and The Lichens

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1. describe the sexual life cycle of the black bread mold *Rhizopus*, and how
2. it reproduces asexually
3. label the various parts of the reproductive structures of a *sac fungus*
4. compare the production of asexual *spores* in *Penicillium* with the production
5. Of asexual spores in *Rhizopus*
6. explain the structure of a *lichen*
7. describe the 3 basic forms of lichens
8. explain how lichens reproduce

Kingdom Plantae: Bryophytes and Ferns

1. compare the development of gametangia and zygotes of members of
2. the plant kingdom with the development of *gametangia* and *zygotes*
3. in members of other kingdoms
4. compare the form and structure of *bryophytes* with the form and structure
5. of more complex plants
6. identify the haploid and diploid phases of a *moss* life cycle by describing the
7. structures and processes in each phase
8. identify the haploid and diploid phases of a *liverwort* life cycle by describing the
9. structures and processes in each phase
10. -compare the asexual and sexual reproduction of *thalloid* and “leafy” *liverworts*
11. that of the *mosses*
12. compare the sporophytes of *ferns* and *mosses*
13. label a diagram of a typical fern life cycle or list the stages of the life cycle
14. explain or recognize the roles played by *prothallus* and *sorus* in a fern life cycle

Kingdom Plantae: Gymnosperms

1. compare the two types of leaves produced by pines
2. compare pine leaves to those of other conifers
3. label the life cycle of a pine tree and indicate where *meiosis*, *fusion of gametes*,
4. *development of an embryo*, and *sperm production* occur
5. compare the structure and functions of male and female pine cones
6. identify and describe or recognize the functions of a pine *micropyle*, *integument*,
7. *pollen chamber*, and *nucellus*
8. explain or recognize the function of the *bladders* or *wings* on pine *pollen grains*
9. using preserved or living specimens, distinguish between a pine, a cycad,

10. *Ginkgo*, *Gnetum*, *Ephedra*, and *Welwitschia*

Kingdom Plantae: Angiosperms (flowering plants— Division Magnoliophyta)

1. identify the parts of a *complete flower* and explain or recognize the function of each part
2. describe the basic variations in *ovary* position and general structure of flowers
3. compare *compound* and *simple ovaries*
4. describe or label the life cycle of a flowering plant
5. explain how an immature *ovule* becomes a *seed*

Fruits, Spices, Survival Plants, and Poisonous Plants

1. distinguish between the various types of fruits
2. identify at least 2 representatives of each fruit type
3. identify parts of plants that are used for specific purposes
4. list several representative survival plants and indicate how they are used
5. give examples of some toxic plants and how they poison humans

Ecology

1. explain *succession* and describe its various forms
2. describe the anatomical modifications of *hydrophytes* and *xerophytes*
3. explain what a *transect* is and how it can be used for analysis of vegetation

Course Content:

Course content will be taken from the adopted text and lab manual, scientific journals, current popular periodicals, appropriate online sources and pertinent reference literature.

Methods of Instruction/Course Format/Delivery: Instruction for this course will include formal instructor lectures, question/answer sessions, small group discussions, videos and interactive software.

Assessment:

Lecture assessment may include face-to-face and online testing including multiple choice, fill-in-the-blank, short answer and short essay questions as well as short reports. Lab assessment may include observations of student work, written and/or oral quizzes, graded exercises and/or reports.

Course Grade:

40% from average of Unit Exams (5 or 6 exams)

20% from assignments

20% from the Final Exam (comprehensive over all but the last unit)

20% from the Laboratory Average (50% from quizzes, 50% from written or observed activities)

Service Learning: Students are expected to complete a course-related service learning project which they select and have approved by the instructor. Points will be awarded based on the nature of the project, quality of the effort, the number of hours required by the project and the appropriate completion of the required documentation and reflection paper. Points will be added to a low unit test score. Failure to complete the service learning project will result in 10 points being deducted from a unit test score.

Texts, Materials, and Supplies:

Text: Stern's Introductory Plant Biology 12th Ed.; James Bidlack, Shelley Jansky; McGraw-Hill Companies

Lab: Stern's Introductory Plant Biology Lab Manual 12th Ed.; James Bidlack; McGraw-Hill Companies

Other:

- For current texts and materials, use the following link to access bookstore listings: <http://www.panola.edu/collegestore.htm>
- For testing services, use the following link: <http://www.panola.edu/instruction/dl/testing.htm>