Modesto Junior College
Course Outline of Record

BOT 101

I. OVERVIEW
The following information will appear in the 2010 - 2011 catalog

BOT 101 General Botany 4 Units
Prerequisite: Satisfactory completion of BIO 101.

Principles of plant life, plant morphology, anatomy, physiology, reproduction, genetics, evolution, and ecology of bacteria, fungi, algae, archaea, slime molds, bryophytes, and vascular plants.

Field trips might be required. (A-F or P/NP - Student choice) Lecture /Lab
Transfer: (CSU, UC) General Education: (MJC-GE: A ) (CSU-GE: B2, B3 ) (IGETC: 5B )

II. LEARNING CONTEXT
Given the following learning context, the student who satisfactorily completes this course should be able to achieve the goals specified in Section III, Desired Learning:

A. COURSE CONTENT

1. Required Content:

   a. Introduction

      i. Brief survey of the plant world

      ii. The systematic study of plants

      iii. Plants and human affairs

   b. Plant organization - vegetative organs

      i. Types of plant tissues

      ii. Vegetative organs of vascular plants

      iii. Convergent evolution and ecological strategies reflected by vegetative plant organs

   c. Reproductive organs and structures: convergent evolution and ecological strategies reflected by reproductive plant organs

   d. Form and function

      i. The nature of plant metabolism

      ii. Extensions of metabolic activities

   e. Raw materials for metabolism

      i. Sources for metabolites

      ii. Principles governing the absorption of metabolites
iii. Xylem transport of water and dissolved substances
iv. Phloem transport of nutrients
v. Soil-water relations: ecological adaptations to drought based on morphological/physiological features

f. Enzymes: catalysts of plant metabolism
g. Anabolism: the synthesis of plant material
   i. Photosynthesis - from simple metabolites to sugars
   ii. Synthesis of other carbohydrates
   iii. Factors affecting photosynthesis
   iv. Fat synthesis
   v. Protein synthesis
   vi. Assimilation - the climax of anabolism
   vii. C3 vs C4 vs CAM photosynthesis as evolutionary adaptations

h. Catabolism: the breakdown of plant materials
   i. Digestion
   ii. Respiration - biological oxidation
   iii. Factors affecting respiration
   iv. The metabolic significance of the Krebs cycle

i. Growth and development
   i. Nature of growth and development
   ii. Factors influencing plant growth
   iii. Mechanisms of growth control
   iv. Plant movements

j. Heredity
   i. Plant genetics

k. Classification and diversity
   i. Types of classification systems
   ii. Classification of the plant and plant-related kingdoms - traditional and modern
   iii. Cladistics: evolutionary relationships based on molecular evidence (Mitochondria and Chloroplast DNA)

l. The origin and evolution of plants
i. The origin of life
ii. Plant evolution

m. Bacteria and Archaea

n. Kingdom Protista
   i. Protistan form and function
   ii. The algal groups - photosynthetic
   iii. The myxomycetes - plasmodial slime molds

o. Kingdom Fungi
   i. Zygomycota - zygosporer formers
   ii. Ascomycota - ascospore formers
   iii. Basidiomycota - basidiospore formers
   iv. Fungi imperfecta
   v. Micorrhizal relationships

p. Non-vascular land plants
   i. the Bryophyta (mosses, hornworts, liverworts)

q. Lower vascular plants
   i. Ferns
   ii. Whisk Ferns
   iii. Lycophytes
   iv. Sphenophytes
   v. Evolutionary trends in lower vascular plants

r. Higher vascular plants
   i. Gymnosperms
   ii. Angiosperms
   iii. Xylem evolution (tracheids to vessels)
   iv. Flower evolution

s. Plant Relationships
   i. The Biosphere
   ii. Ecological principles/ecosystem dynamics
iii. The plant community

2. **Required Lab Content:**

   a. **Scientific Method, Microscopy and plant cells/tissues**
      i. Be able to distinguish the various structures and organelles of living cells with a light microscope.
      ii. Distinguish between cytoplasmic streaming and independant movement of organisms.
      iii. Prepare laboratory drawings and be familiar with the use of both compound and dissecting microscopes.

   b. **Plant Biological Molecules and Osmosis**
      i. Know and be able to describe the main groups of biological molecules found in plants.

   c. **Photosynthesis**
      i. Demonstrate a simple paper chromatography technique and to describe the sequence of plant pigments that separated on the chromatograph.
      ii. Describe the main reactants and products of photosynthesis.
      iii. Identify the role of rubisco in the light independent reactions of photosynthesis.

   d. **Respiration**
      i. Describe the main reactants and products of respiration.
      ii. Identify oxygen as the primary electron acceptor from the electron transport chain reactions.
      iii. Demonstrate an understanding of the role of ATP synthase.

   e. **Mitosis/Meiosis and Introduction to Life Cycles**
      i. Describe and discuss what occurs in each of the stages of Mitosis and Meiosis.
      ii. Identify cellular structures involved with mitosis.
      iii. Draw a table and calculate the mitotic index observed in one field of view at high power.

   f. **Plant Propagation**
      i. Propagate new plants from stems, roots and leaves
      ii. Perform a plant propagation on a culture medium of a plant from a seed embryo and have an understanding of sterile techniques.

   g. **Stem Morphology and Physiology**
      i. Know the differences between monocot and dicot stems.
      ii. Identify and know the parts and functions of the vascular bundle.
h. Root Morphology
   i. Differentiate between root hairs and lateral roots.
   ii. Recognize the location and composition of Casparian strips.

i. Leaves
   i. Locate and know the parts and functions of structures observed in the cross sections of various types of leaves.
   ii. Be able to recognize guard cells from other epidermal cells.

j. Plant Hormones and Tropisms
   i. To understand the affects of auxin and gibberillin on stem growth.
   ii. Observe and know what tropisms are and why they occur.

k. Tree Identification
   i. Identify from memory several tree specimens located within the Modesto Junior College Arboretum.
   ii. Examine and observe plant diversity.

l. Plant taxonomy/Identification, How to use the Jepson Manual
   i. Use the Jepson Manual to determine the families of plant specimens.
   ii. Recognize qualities that are common to specific families of plants.

m. Plant Collection
   i. Demonstrate good plant collection procedures and the proper use of a plant press.
   ii. Properly mount and label plant specimens for their collection and the MJC herbarium.

n. Genetics, Purple Hairy Fast Plants
   i. Diagram monohybrid and dyhybrid crosses
   ii. Demonstrate how to calculate probability

o. Prokaryotes and Protists
   i. Know the parts and structure of a dinoflagellate and of a kelp or other large seaweed.
   ii. Understand how a diatom is constructed and moves.

p. The Kingdom of Fungi
   i. Know the sexual life cycle of Rhizopus and how it reproduces asexually.
   ii. Prepare wet mounts and observe various mushroom specimens (identify the mycelium and basidium).
q. Lichens
   i. To understand the nature and structure of a lichen, the basic forms of lichens, and how lichens reproduce.

r. Seedless Plants
   i. Describe the life cycle of a moss, liverwort, and fern.
   ii. Recognize the form and structure of bryophytes and how they differ from more complex plants.

s. Gymnosperms
   i. Distinguish a pine, a cycad, Ginkgo, Gnetum, Ephedra, and Welwitshia from one another.
   ii. Recognize the differences between male and female cone.

t. Angiosperms
   i. Illustrate an understanding of the life cycle of a flowering plant and how a mature ovule becomes a seed.
   ii. Describe the various ovary positions and general structure of flowers.

u. Fruits
   i. Describe and recognize different types of fruits.
   ii. Gain an understanding of the roles of each of the various parts of fruits.

v. Berkeley Botanic Garden Tour (Field Trip)
   i. To gain an understanding and appreciation of the wide diversity of plants and their niche in their various natural environments.
   ii. Recognize the importance of conservation of plant diversity.

w. Caswell Park (Field Trip)
   i. Observe a natural (declining) riparian oak woodland, which once existed throughout the Central Valley.
   ii. Identify several native species of plants.

B. ENROLLMENT RESTRICTIONS

1. Prerequisites
   Satisfactory completion of BIO 101.

2. Requisite Skills
   Before entering the course, the student will be able to:
a. Organize and interpret data from scientific experiments in biology and formulate conclusions.
b. Organize and interpret data from scientific experiments in biology and formulate conclusions.
c. Prepare labeled laboratory drawings to scale.
d. Demonstrate proficiency with laboratory equipment, procedures and dissection.
e. Analyze the role of biological science in society.
f. Distinguish between generalizations and principles, theories and laws, science and pseudoscience.
g. Apply the scientific methodology of investigation.
h. Describe the structure, function and relationships of DNA, RNA and proteins in living systems.
i. Describe the process of protein synthesis and its regulations as it occurs in eukaryotic and prokaryotic organisms.
j. Summarize the historical basis for biological principles and relate current research to these principles.
k. Explain the process of evolution in relation to the diversity of life.
l. Relate chemical and physical reactions to the processes of life.
m. Describe how the processes of adaptation and natural selection are illustrated at the molecular, cellular, organismal and population level.
n. Describe homeostatic mechanisms of living organisms and relate these strategies to the process of evolution.
o. Relate the concept of adaptation to the processes of reproduction and development in living organisms.
p. Explain the basic processes of genetic engineering and analyze the influence of biotechnology on society.
q. Distinguish between transmission genetics and molecular genetics.
r. Define the characteristics that distinguish living from non-living things.
s. Interpret evidence regarding the origin of life.
t. Describe hierarchical levels of organization ranging from atoms to the biosphere.

C. HOURS AND UNITS

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D. METHODS OF INSTRUCTION (TYPICAL)

Instructors of the course might conduct the course using the following method:

1. Lecture as related directly to textbook and other reading assignments.
2. Laboratory and field: Usage of the laboratory and field experience to review, analyze and reinforce
the lecture experiences. Laboratory and field experiences require written reports.

3. Audio-visual materials (Power point presentations, videos, software, internet).

4. Reading assignments from periodicals require students to review various perspectives on scientific thought as related to this course.

5. Laboratory assignments require students to apply the scientific method and practice critical thinking.

6. Written reports require students to organize, summarize and portray their findings. Students will develop appropriate methodologies to the approach, analysis and logical conclusion to historic, current, and future scientific problems and questions as related to this course.

E. ASSIGNMENTS (TYPICAL)

1. EVIDENCE OF APPROPRIATE WORKLOAD FOR COURSE UNITS
   Time spent on coursework in addition to hours of instruction (lecture hours)
   a. 2-3 Chapters of reading from Botany Textbook per week
   b. Homework Packs - 3 per semester
   c. Botany Article Summary, students will summarize a Botany article from a scientific journal publication - 1 per semester
   d. Online WebCT Discussion Questions, 10 per semester
   e. Plant Collection with written field notes, 1 per semester
   f. 20 laboratory exercise reviews
   g. 2 formal laboratory reports

2. EVIDENCE OF CRITICAL THINKING
   Assignments require the appropriate level of critical thinking
   a. Exam questions:
      i. Describe the concept of alternation of generations. How are the terms sporophyte and gametophyte related to this concept?
      ii. When and why do plants undergo photorespiration? Describe what happens during photorespiration. How does rubisco facilitate photorespiration?
      iii. What is so special about seeds? How do they convey an evolutionary advantage to plants?
      iv. In garden pea plants, a cross is made between true-breeding purple flowered plants (P) and true breeding white flowered plants (p). Purple flower color is dominant over white flower color. What are the genotypes of the F1 plants? If two of the F1 generation offspring were crossed what would be the phenotypes and genotypes of the F2 offspring?
   b. Laboratory Exercise Questions:
      i. Would your graph look different if you only plotted root or hypocotyl growth?
      ii. What supports the developing embryo until the time it can photosynthesize? What types of developmental events enable the emerging plant to shift its dependency from stored energy to energy from light?
      iii. How could you investigate and compare the rates of germination in various brassicas.
      iv. Is the sporophyte an "independent" or "dependent" Organism?
c. Homework Pack Questions:
   i. What lives in the kelp forests? Why do kelp forests house so much biodiversity? What did Darwin think of this?
   ii. Differentiate between the life cycles of bryophytes, lycophytes, and pteridophytes.
   iii. Diagram and label the basic form of a flower. What is inflorescence and what are some of the main types?
   iv. Compare and contrast the processes of apoplastic and symplastic phloem loading.
   v. Gregor Mendel's work with Pisum sativa (garden pea) led to his laws of heredity. Briefly describe why Mendel used Pisum in his research. What did he show to be true about dominant and recessive traits? What did he suggest in each of his laws of heredity? Refer to your book or check out Mendelweb at: [http://www.mendelweb.org/mendel.html](http://www.mendelweb.org/mendel.html)

F. TEXTS AND OTHER READINGS (TYPICAL)

III. DESIRED LEARNING

A. COURSE GOAL
   As a result of satisfactory completion of this course, the student should be prepared to:
   understand, communicate and apply their knowledge of the complexity in structure, form and function of plants, fungi, and bacteria.

B. STUDENT LEARNING GOALS
   Mastery of the following learning goals will enable the student to achieve the overall course goal.

1. Required Learning Goals
   Upon satisfactory completion of this course, the student will be able to:
   a. follow the scientific method to set up or identify a problem.
   b. utilize guidelines to increase depth and objectivity of observational skills.
   c. check for mistakes in observation or procedure.
   d. draw conclusions from the results.
   e. locate information from technical journals and publications, library resources, and current methods of knowledge storage and retrieval.
   f. differentiate between fundamental concepts and accidental or temporary phenomena in the world of botany.
   g. apply the fundamental body of knowledge in botany, which is the prerequisite to any further study in plant science and related fields.
h. demonstrate a working vocabulary of structure, function, and concepts, included in the field of botany.

i. interrelate the diversity and taxonomy of plants, fungi, algae, and slime molds and interpret the relationships of groups with each other.

j. describe how plants are similar and how they differ from other living things.

k. identify and describe the major physiological activities of plants.

l. describe the significance of plants and photosynthetic organisms to all of life on earth.

m. describe the interrelationships of plants and plant-like organisms to other living organisms in the environment.

n. describe the interrelationships of plants and plant-like organisms to the abiotic factors of the environment.

o. describe the Earth’s major biomes and their relationship to plants and plant-like organisms.

p. discuss the agricultural, economic and environmental importance of plants.

2. **Lab Learning Goals**

   Upon satisfactory completion of the lab portion of this course, the student will be able to:

   a. prepare laboratory drawings and be familiar with the use of both compound and dissecting microscopes.

   b. apply the scientific method to identify questions, make hypotheses, test hypotheses, analyze results and make conclusions.

   c. accurately record data from the results.

   d. develop information through experimentation, observation, evaluation and familiarity with plants, fungi, algae, slime molds, and bacteria.

   e. follow laboratory directions and laboratory manual instructions.

   f. dissect plants and plant organs with neatness and precision to enable proper evaluation of the specimen.

   g. use the Jepson Manual to determine the families of plant specimens.

   h. demonstrate good plant collection procedures and the proper use of a plant press.

   i. identify from memory several tree specimens located within the Modesto Junior College Arboretum.

   j. identify and describe the anatomy and morphology of plants, fungi, and algae examined in this course.

   k. use laboratory equipment and the tools of botany.

   l. develop information through experimentation, observation, evaluation, and familiarity with plants, fungi, algae, and slime molds.

   m. dissect plants and plant organs with neatness and precision to enable proper evaluation of the specimen.

   n. identify and describe the anatomy and morphology of plants, fungi, algae, and slime molds treated in this course.
IV. METHODS OF ASSESSMENT (TYPICAL)

A. FORMATIVE ASSESSMENT

1. Written reports (research, review, critiques)
2. Plant collection with written field notes
3. Laboratory and field trip reports (written)
4. Laboratory and field identification of plant groups and species
5. Lecture Quizzes
6. Unit Exams

B. SUMMATIVE ASSESSMENT

1. Cumulative final examination
2. Two laboratory practicums