BIOL 0002 - BOTANY

Catalog Description

Prerequisite: Completion of intermediate algebra or higher with grade of "C" or better or appropriate placement
Advisory: Eligibility for ENGL 1A
Hours: 144 (54 lecture, 90 laboratory)
Description: Part of the BIOL 1/BIOL 2/BIOL 3 course series for life science majors. Introduction to the principles of botany, including diversity, classification, life cycles, and evolutionary trends of plants, fungi, algae, and cyanobacteria. Emphasis is on the anatomy, morphology, physiology, development, evolution, and ecology of plants. Field trips may be required; transportation will be provided. Recommended for biology majors and students in environmental science, plant biology or related programs. Non-life science majors see BIOL 14, BIOL 21, or BIOL 24. Not recommended for students taking BIOL 140. (C-ID BIOL 155) (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Identify and describe primary and secondary plant metabolites and their significance to both plants and humans.
- CSLO #2: Identify and describe the major cells and tissues in roots, stems, leaves, wood, and reproductive parts.
- CSLO #3: Compare and contrast structure and function of major tissue types in stems, roots, and leaves, of angiosperms and gymnosperms.
- CSLO #4: Describe the fundamental characteristics of plant-based viruses, cyanobacteria, photosynthetic protists, fungi, and members of the plant kingdom (bryophytes, ferns, gymnosperms and angiosperms).
- CSLO #5: Detail the broad evolution of plants and their association with the current ecological landscape.

Effective Term

Fall 2024

Course Type

Credit - Degree-applicable

Contact Hours

144

Outside of Class Hours

108

Total Student Learning Hours

252

Course Objectives

Course objectives are linked to items in the Course Content Outline (in parentheses).
Lecture Course Objectives:
1. Identify and describe secondary plant metabolites and their significance to both plants and humans (#2)
2. Correlate the basic structural features of plant cells with the functions of the structures in plants (#3, #4, #5, #6, #7)
3. Compare and contrast structure and function of major tissue types in stems, roots, and leaves, of angiosperms and gymnosperms (#4, #5, #6, #7)
4. Diagram the major features of life cycles in fungi, bryophytes, ferns, gymnosperms, and angiosperms (#15, #16, #17, #18, #19)
5. Describe the fundamental characteristics of plant associated viruses and photosynthetic and plant associated prokaryotes and protists (#13, #14)
6. Identify and describe the general characteristics and evolution of the Fungi, photosynthetic protists and Plant kingdom (#12, #13, #14, #15, #16, #17, #18, #19)
7. Identify the major pathways of water and dissolved substances in plants (#3, #4, #5, #6, #7, #11)
8. Categorize and describe the factors controlling plant growth (#3, #9, #10)
9. Compare and contrast the various common plant hormones by bioassay and behavioral response (#9)
10. Identify the basic pathways for light dependent reactions as they apply to the behavior of plant responses (#8)
11. Compare and contrast C3, C4 and CAM photosynthesis (#8)
12. Outline and describe the events and cite examples of evolution in the plant kingdom (#12, #15, #16, #17, #18, #19)
13. Categorize and arrange organisms studied in logical evolutionary and phylogenetic order (#12, #13, #14, #15, #16, #17, #18, #19)
14. State and apply major features of currently accepted plant classification (#12, #13, #14, #15, #16, #17, #18, #19)
15. Identify ways in which plants interact with their environment, and implications of these interactions (#9, #10, #20, #21
16. Identify the major biomes by their climatic, latitudinal and biological indicators (#20)
17. Apply plant ecological principles such as food chains and food webs, primary productivity, nutrient cycling, and ecosystem succession to any major world ecosystem or community (#20)
18. Develop and describe a timeline for ecosystem succession (#20)
Laboratory Course Objectives:
1. Use compound and dissecting microscopes to investigate plant structures (using both fresh and prepared specimens) (#1, #2, #3, #4, #5, #6)
2. Dissect fresh plant specimens under a dissecting microscope (#1, #2, #3, #4, #5, #6, #13, #14, #15, #16, #17)
3. Illustrate and identify cellular plant structures (#2, #3, #4, #5, #6, #13, #14, #15, #16, #17)
4. Identify and locate major stem, root, leaf, and reproductive tissues (#2, #3, #4, #5, #6, #13, #14, #15, #16, #17)
5. Differentiate and characterize the distinguishing features of selected representatives of the following groups of organisms: bacteria, archaea, protista, fungi, lichens, bryophytes, ferns, gymnosperms, and angiosperms (monocots and dicots) (#11, #12, #13, #14, #15, #16, #17)
6. Categorize and identify plant specimens according to taxonomy, family, and species (#11, #12, #13, #14, #15, #16, #17)
7. Analyze experimental data regarding plant physiology, hormones, water relations, and nutrient requirements (#2, #8, #9, #10)
8. Evaluate various soil/mineral deficiencies in plants by recognizing/identifying specific plant responses (#2, #10)

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Life Sciences
  - AS - Life Science Lab
- CSU GE Applicability (Recommended-requires CSU approval)

- CSUGE - B2 Life Science
- CSUGE - B3 Lab Activity

- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 5B Biological Science
  - IGETC - 5C Laboratory Science

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: To address lecture course objective #1, "Identify and describe secondary plant metabolites and their significance to both plants and humans", students might participate in a class discussion about the features of and differences between primary and secondary metabolites, including the three classes of secondary metabolites, and examples of these metabolites that are used in medicine. Students could be evaluated on participation, accuracy of information and completeness of information. Rubric grading.
- Essay Examinations
  - Example: To address lecture course objective #3, "Compare and contrast structure and function of major tissue types in stems, roots, and leaves, of angiosperms and gymnosperms", students might answer an essay question on an exam that asks them to explain the location and role of the endodermis in regulating the movement of substances into and out of the root's vascular cylinder. Students could be evaluated on the accuracy and completeness of their answer. Rubric grading.
- Objective Examinations
  - Example: To address lecture course objective #1, "Identify and describe secondary plant metabolites and their significance to both plants and humans", students might answer a quiz or exam question asking them to describe or distinguish between primary and secondary metabolites, including the three classes of secondary metabolites, and provide examples of these metabolites that are used in medicine. Students could be evaluated on accuracy and completeness of their answer. Rubric grading.
- Projects
  - Example: To address lecture course objective #13, "Categorize and arrange organisms studied in logical evolutionary and phylogenetic order" and lab course objective #6, "Categorize and identify plant specimens according to taxonomy, family, and species", students might be asked to complete a semester project involving the collection, identification, and proper preparation of herbarium specimens. Students could be evaluated based on the number of specimens collected, the diversity of the specimens, the quality of the specimens and herbarium sheets, and the accuracy of species identifications. Rubric grading.
- Reports
  - Example: To address lab course objective #7, "Analyze experimental data regarding plant physiology, hormones, water relations, and nutrient requirements", students might conduct an experiment on bean and pea growth and then prepare a formal lab report describing the experiment and results and including analysis of those results. Students could be evaluated based on the composition of the lab report, the accuracy of the information, and the scientific validity of conclusions drawn. Rubric grading.
- Skill Demonstrations
  - Example: To address lecture course objective #13, "Categorize and arrange organisms studied in logical evolutionary and phylogenetic order" and lab course objective #6, "Categorize and identify plant specimens according to taxonomy, family, and species", students might collect, identify, and properly prepare specimens for inclusion in an herbarium. Students could be evaluated on their skill in collecting specimens of appropriate species, size, and condition. Students could also be evaluated on their skill in pressing and mounting those specimens on an herbarium sheet with all pertinent specimen information documented. Rubric grading.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. To address lab course objective #7: "Analyze experimental data regarding plant physiology, hormones, water relations, and nutrient requirements", the instructor may prepare a demonstration on the proper technique for applying hormone to the apical meristem of beans and peas. After demonstration, instructor will ask students to perform the task and collect experimental data twice weekly for three weeks. Students will have become familiar with technique by reading both lab manual and textbook, writing information in lab manual, and analyzing the outcome.
2. To address lab course objective #6: "Categorize and identify plant specimens according to taxonomy, family, and species", the instructor could demonstrate the local plants with live specimens and identify methods for categorization. Students will then be able to correctly identify these local plants in the field or on a lab practical exam.

Lecture:

1. To address lecture course objective #3: "Compare and contrast structure and function of major tissue types in stems, roots, and leaves, of angiosperms and gymnosperms, the instructor might prepare lectures that highlight, define, and compare the major tissues throughout all the regions in a plant. The lecture could include images that show where all the tissues are located and types of cells involved. Students will then be able to correct answer homework or exam questions about these tissue types.
2. To address lecture course objective #11: "Compare and contrast C3, C4 and CAM photosynthesis", the instructor could prepare a lecture outlining and detailing the events of C3 photosynthesis and then use this mechanism to explain and compare C4 and CAM photosynthesis. The instructor could use models, videos, and diagrams to explain these processes. Students will then be able to participate in a class discussion concerning the advantages and disadvantages of each type of photosynthesis.

Distance Learning

1. To address lecture course objective #7, "Identify the major pathways of water and dissolved substances in plants", the instructor might prepare a lecture to post online that explains the basic movement of water and dissolved substances in plants, providing examples of different substances and scenarios. This online lecture might include text, audio (with transcript), and/or captioned video presentation of information.The students will be listening and/or watching this lecture, taking notes, asking clarifying questions (via chat, Zoom, email, etc.), and making connections to previous lecture topics and/or experiments conducted in the laboratory. A student can demonstrate mastery of this objective in multiple ways. One example is to successfully answer an online multiple choice or essay exam question that asks the student to correctly identify the sequence of structures that water and/or dissolved substances move through in a plant. Another example is to ask the student to create an annotated diagram of the flow patterns of water and/or dissolved substances in a plant. Students could create this diagram digitally and upload the file to the course LMS, or create the diagram on paper and then scan/photograph the diagram and upload the resulting file to the course LMS.
2. To address lecture course objective #15, "Identify ways in which plants interact with their environment, and implications of these interactions", the instructor might guide students in an online discussion of the various interactions that plants participate in, asking students to consider specific examples of species that are found in California to illustrate those interactions.

Typical Out of Class Assignments

Reading Assignments

1. Read a periodical (e.g. Science News, Nature, National Geographic) on plants and food and be prepared to discuss in class. 2. Conduct research on assigned protists and present their findings to the rest of the class via presentation (e.g. PowerPoint). 3. Read the assigned pages from the textbook and be prepared to discuss primary metabolite review for class.

Writing, Problem Solving or Performance

1. Complete a formal laboratory report that contains an introduction, purpose, procedure, and materials used for each lab. 2. Conduct an experiment on bean and pea growth when subjected to various hormones, collect data for 4 weeks, and determine the effect of the hormone on plant growth. 3. Complete short-answer questions from a published laboratory manual each week regarding topics related to course.

Other (Term projects, research papers, portfolios, etc.)

1. Collect 25 plants from the wild, identify to genus, mount, and display them, and present their collection to the class. 2. Conduct research on an aspect of plant physiology. The paper submitted must be 7 - 10 pages in length and consist of an Abstract, Introduction, Methods and Materials, Presentation of Data, Discussion, and Conclusion.

Required Materials

- Raven Biology of Plants
  - Author: Evert and Eichhorn
  - Publisher: Macmillan
  - Publication Date: 2013
  - Text Edition: 8th
  - Classic Textbook?:
  - OER Link:
  - OER:
- A Photographic Atlas for the Botany Laboratory
  - Author: Rushforth et al.
  - Publisher: Morton
  - Publication Date: 2016
  - Text Edition: 7th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Botany: An Introduction to Plant Biology
  - Author: Mauseth
  - Publisher: Jones & Bartlett
  - Publication Date: 2012
  - Text Edition: 7th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Botany: A Lab Manual
  - Author: Mauseth
  - Publisher: Jones & Bartlett
  - Publication Date: 2016
  - Text Edition: 6th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Introduction to Plant Science: Investigating the Green World
  - Author: McKenney, Chau, and Shuch
  - Publisher: Kendall Hunt
  - Publication Date: 2019
  - Text Edition: 2nd
  - Classic Textbook?:
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.