GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: BIO 5 DIVISION: 10 ALSO LISTED AS:

TERM EFFECTIVE: Spring 2021 CURRICULUM APPROVAL DATE: 12/8/2020

SHORT TITLE: GENERAL BOTANY

LONG TITLE: General Botany

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
4	18	Lecture:	3	54
		Lab:	3	54
		Other:	0	0
		Total:	6	108

Out of Class Hrs:	108.00
Total Learning Hrs:	216.00

COURSE DESCRIPTION:

General Botany is designed for students majoring in biology and/or its related disciplines. This course introduces the evolution and diversity of botanical organisms and begins with a brief review of plant like organisms (protista and fungi) and continues with an emphasis in the plant kingdom for the remainder of the course. The course will include topics such as life cycles, embroyonic development, morphology, physiology, taxonomy and plant systematics. Principles of population ecology, community ecology, ecosystems interactions, biotechnology and agriculture are highlighted in this course. (C-ID: BIOL 155) PREREQUISITE: Mathematics 235 or Mathematics 240 with a grade of 'C' or better, or skills equivalent to those in an Intermediate Algebra course, or appropriate placement. ADVISORY: Chemistry 1A, Biological Science 1, and and college-level reading and writing skills.

PREREQUISITES:

Completion of MATH 235, as UG, with a grade of C or better.
OR
Completion of MATH 240, as UG, with a grade of C or better.
OR
Score of 33 on Intermediate Algebra
OR
Score of 13 on Pre-Calculus
OR
Score of 2600 on Accuplacer Math
OR

Score of 2600 on MM CCCApply Math
OR
Score of 2600 on MM Placement Tool Math

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES
L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:
02 - Lecture and/or discussion
03 - Lecture/Laboratory
04 - Laboratory/Studio/Activity
04B - Laboratory - LEH 0.75
05 - Hybrid
71 - Dist. Ed Internet Simultaneous
72 - Dist. Ed Internet Delayed
73 - Dist. Ed Internet Delayed LAB
73B - Dist. Ed Internet LAB-LEH 0.75

STUDENT LEARNING OUTCOMES:

By the end of this course, a student should:

1. Identify characteristics of major botanical taxa (protists, fungi and green plants) and their phylogenetic relationships.
2. Identify the diversity of botanical structures and relate the structures to their functions. Apply knowledge of plant physiology and structure to the use of plants in agriculture and biotechnology.
3. Compare and contrast the differences in development and life cycles across the major taxa of protists, fungi and botanical organisms.
4. Evaluate the evolutionary relationship of botanical organisms to each other structure and ecology of plants to their classification.
5. Discuss the importance of habitat, sustainable ecology and biotechnology in the field of Botany.
6. Develop basic laboratory and dissection skills, which may be utilized to further investigations.
7. Apply scientific methodology and reasoning through active experimentation and experiences.

COURSE CONTENT:

Curriculum Approval Date: 12/8/2020

LECTURE CONTENT:

3 LECTURE HOURS

Lecture Objectives:

1. Discuss the scientific method.
2. Describe the importance of plants to all life forms.
3. Discuss the impact of humans on the environment.
4. Describe the attributes of living things.
5. Define and discuss basic principles of organic and biochemistry.
6. Discuss the different forms of energy and the laws or thermodynamics.
7. List and describe the organic and inorganic chemical found in plants, including proteins, carbohydrates, lipids and nucleic acids.
8. Discuss the importance of acids, bases and buffers.

Assignments: Read text. Review text summaries and questions in preparation for exam.

3 LECTURE HOURS

Lecture Objectives:

1. Discuss the history of the development of cell theory.
2. List and describe plant cell organelles.
3. Discuss how communication occurs between plant cells.
4. Describe the plant cell cycle and the phases of mitosis.
5. Discuss the chemical composition and functions of DNA.
6. Describe DNA replication.
7. Describe the processes of transcription and translation.
8. Distinguish between germline and somatic mutations.

Assignments: Read text. Review text summaries and questions in preparation for exam.

3 LECTURE HOURS

Lecture Objectives:

1. Define the term meristem and list and identify the locations of meristematic tissue in plants.
2. List and discuss the conducting tissues of plants.
3. Describe the epidermis, periderm and secretory tissues of plants.

Assignments: Read text. Review text summaries and questions in preparation for exam.

3 LECTURE HOURS

Lecture Objectives:

1. List and describe the basic functions and forms of roots.
2. Describe the locations and functions of: root cap, region of cell division, region of cell elongation, and region of maturation (for root hairs and all tissues).
3. Discuss the functions of the pericycle and endodermis.
4. Discuss human uses of roots.
5. List, compare and contrast the different types of specialized roots.
6. Describe the horizons of a soli profile.
7. Describe the process of soil development.
8 .Describe the materials that comprise soil.
9. List and describe the different factors that contribute to a productive agricultural soil.
10. Discuss the movement of water within soils, and water availability.
11. Define and discuss: soil texture, soil texture.
12. Discuss the relationship between pH, nutrient availability, and plant growth.

Assignments: Read text. Review text summaries and questions in preparation for exam.

COURSE CONTENT(CONTINUED):

LECTURE CONTENT(CONTINUED):

3 LECTURE HOURS

Lecture Objectives:

1. List and describe specialized stems, including stolons, rhizomes, tibers, corms, bulbs, cladophylls and tendrils.
2. Describe the tissues that develop from shoot apices and the meristems from which each tissue develops.
3. Describe and discuss the functions of vascular cambium, cork cambium, stomata and lenticels.
4. Compare and contrast the stems of herbaceous and woody dicots with the stems of monocots.
5. Describe the composition and structure of wood.
6. Relate the structures of wood (sapwood, heartwood and bark) to its commercial use as lumber.
7. Discuss the human uses of wood and other stems.

Assignments: Read text. Review text summaries and questions in preparation for exam.

3 LECTURE HOURS

Lecture Objectives:

1. Describe the structure of a typical leaf and relate the structure to the functions of a leaf.
2. Discuss the development of leaves.
3. Discuss the process of transpiration and guttation.
4. Discuss the attachment, arrangement, and venation of leaves.
5. Compare and contrast monocot and dicot leaves.
6. Describe simple versus compound leaves and the different types of compound leaves.
7. Discuss the structure and importance of stomata.
8. Describe specialized leaves, including but not limited to:

shade leaves, spines, thorns, tendrils, bracts, reproductive leaves, insect-trapping leaves, and bladder leaves.

9. Discuss the changes in leaves that occur in response to changes in environment, including abscission and pigment changes.
10. List and discuss human uses of leaves.

Assignments: Read text. Review text summaries and questions in preparation for exam.

3 LECTURE HOURS

Lecture Objectives:

1. Describe the structures of a typical flower.
2. Compare and contrast monocot and dicot flowers.
3. Define and discuss the terms annual, biennial, perennial.
4. Discuss the development and basic structure of fruits.
5. List and describe the different types of fruits, including drupes, berries, pomes,

follicles, legumes, siliques, capsules, achenes, nuts, grains, samaras, schizocarps, aggregate and multiple fruits.

6. Discuss various mechanisms of seed dispersal.
7. Describe the structures of a seed and their functions.
8. Discuss the process of and the requirements for germination.
9. Discuss factors that affect seed viability and the length of time that various seeds may remain viable.

Assignments: Read text. Review text summaries and questions.

COURSE CONTENT(CONTINUED):

LECTURE CONTENT(CONTINUED):

3 LECTURE HOURS

Lecture Objectives:

1. Define and discuss: diffusion, osmosis, turgor, imbibition, plasmolysis, active transport.

2. Discuss the cohesion-tension theory and the pressure-flow hypothesis and their relationship to the movement of water in plants.

3. Relate the movement of water and nutrients in plants to plant structure.

4. List and discuss plant micronutrient and macronutrient requirements.

Assignments: Read text. Review text summaries and questions.

3 LECTURE HOURS

Lecture Objectives:

1. List the reactants and products for the general equations for photosynthesis and respiration.

2. Discuss the relationship between photosynthesis and respiration.

3. Discuss oxidation-reduction reactions and their roles in photosynthesis and respiration.

4. Define metabolism, anabolism and catabolism.

5. List the principle reactants and the principle products of the light-dependent and light-independent reactions of photosynthesis.

6. Compare and contrast light-dependent and light-independent reactions of photosynthesis.

7. Describe the roles of and requirements for carbon dioxide, water and light in photosynthesis.

8. Recognize and describe the chlorophyll molecule.

9. Compare and contrast chlorophyll a and chlorophyll b.

10. List and discuss the roles of other plant pigments.

11. Describe the structures of the chloroplast and their relationship to photosynthesis.

12. Discuss how light energy is transformed into chemical energy through the reactions of photosynthesis.

13. Describe the roles of the NADPH and ATP in photosynthesis.

14. Discuss the relationship between photosystem I and photosystem II.

15. Discuss photolysis and photophosphorylation. Compare and contrast cyclic and non-cyclic photophosphorylation.

16. Discuss how the chemiosmotic theory explains both the synthesis of ATP in photosynthesis and in oxidative phosphorylation.

17. Describe the five main steps of carbon reduction of the light independent reactions.

18. Compare and contrast the C3, C4 and CAM pathways of photosynthesis.

19. Discuss the processes of sulfate and nitrate reduction in chloroplasts.

20. List the major reactants, and products of glycolysis, the Krebs cycle, and respiration.

21. Define, compare and contrast the processes of fermentation and anaerobic respiration.

22. Define and discuss assimilation and digestion in plants.

Assignments: Read text. Review text summaries and questions.

COURSE CONTENT(CONTINUED):

LECTURE CONTENT(CONTINUED):

3 LECTURE HOURS

Lecture Objectives:

1. Define the terms growth and development.
2. Compare and contrast hormones, enzymes, and vitamins.
3. Discuss the roles of auxins, gibberellins, and cytokinins in plant growth.
4. Discuss how plant growth hormones are use commercially.
5. Define and discuss senescence and apical dominance.
6. Describe plant movements, including nutations, nodding, twining, contraction and nastic movements, phototropism, geotropism and other tropic movements, and turgor movements.
7. Discuss circadian rhythms in plants.
8. Describe the movements that occur in slime molds, cyanobacteria, and some protists.
9. Define photoperiodism, thermoperiodism.
10. Discuss phytochromes, cryptochromes and their roles.
11. Discuss dormancy, quiescence and the factors that may affect germination.

Assignments: Read text. Review text summaries and questions in preparation for quiz.

3 LECTURE HOURS

Lecture Objectives:

1. Compare and contrast sexual and asexual reproduction.
2. List and describe the phases of meiosis.
3. Define and discuss the terms zygote, haploid, diploid, triploid, tetraploid, sporophyte, gametophyte, fertilization or syngamy.
3. Discuss Alternation of Generations as it occurs in plants.
4. Discuss the work of Gregor Mendel.
5. Describe the principles of dominant factors, recessive factors, and independent assortment.
6. Define the terms genotype, phenotype, homozygous, heterozygous, homozygous.
7. Solve simple genetic problems demonstrating monohybrid crosses, dihybrid crosses, complete dominance and incomplete dominance, and linked traits.
8. Discuss the Hardy-Weinberg Law.

Assignments: Read text. Review text summaries and questions in preparation for exam.

3 LECTURE HOURS

Lecture Objectives:

1. Discuss the shift from a hunter-gatherer to an agricultural society.
2. List the six species of plants that provide most of the human caloric needs.
3. Describe how human selection has changed changes in plant population phenotypes.
4. Discuss strategies used in standard plant breeding, including self-pollination and cross- pollination, inbreeding, pure line selections, mass selection, and outcrossing.
5. Define and discuss: heirloom varieties, germplasm, gene banks.
6. Describe and discuss recombinant DNA techniques used for sexually incompatible germplasm, including gene splicing, gene synthesizing, use of plasmids, and transformation.
7. Discuss the pros and cons of the use of transgenic plants.
8. Describe techniques used in seed propagation and storage.
9. Describe techniques used in asexual plant propagation, including cuttings, grafting, natural propagules, and micropropagation.

Assignments: Read text. Review text summaries and questions.

COURSE CONTENT(CONTINUED):

LECTURE CONTENT(CONTINUED):

3 LECTURE HOURS

Lecture Objectives:

1.Summarize the early development of evolutionary theory.

2. Discuss the contributions of Charles Darwin to the science of evolution.

3. Discuss the evidence for evolution.

4. Discuss the significance of natural selection, mutation, migration and genetic drift to the process of evolution.

5. Differentiate between microevolution and macroevolution.

6. Describe how reproductive, geographic, ecological, mechanical and other types of isolation contribute to the evolution of species.

7. Discuss the role of hybridization and asexual reproduction, including apomixis, in evolution.

8. Discuss the reasons for the continuing controversy over evolutionary theory.

3 LECTURE HOURS

Lecture Objectives:

1. Discuss the value of scientific nomenclature, how it was developed, and how it currently used.

2. Discuss the development of the kingdom concept of classification, and the six kingdom system classification currently in common use.

3. List the different groups used in the taxonomical hierarchy.

4. Discuss the use of cladistics to establish natural relationships.

5. Explain the use of a dichotomous key in the identification of an organism.

6. Distinguish between prokaryotic and eukaryotic cells.

7. Discuss how genetic variation occurs in bacteria and other prokaryotes.

8. Discuss why it is difficult to classify prokaryotes, and list and describe criteria used to classify and identify prokaryotes.

9. Describe forms of nutrition in bacteria.

10. Discuss how bacteria are useful to humans.

11. Discuss how bacteria and viruses are harmful to humans.

12. Describe how microorganisms are transmitted, and how transmission can be controlled.

13. Describe the cyanobacteria and differentiate them from the true bacteria.

14. Discuss the roles of cyanobacteria in human existence.

15. Describe the kingdom archaea, and discuss roles of members of this kingdom in human existence.

16. Define and differentiate between viruses, viroids and prions.

17. Discuss the relevance of viruses, viroids and prions.

Assignments: Read text. Review text summaries and questions in preparation for quiz.

3 LECTURE HOURS

Lecture Objectives:

1. List the criteria for the identification of an organism as a member of the Kingdom Protista.

2. Describe the major characteristics of and important members of major phyla of protists and other organisms.

3. Discuss the human relevance of these organisms.

4. List the characteristics of members of the Kingdom Fungi.

5. Distinguish the phyla and subphyla of fungi based on their cell structure, type of hypha, and type of reproduction.

6. Discuss the major phyla and subphyla and their relevance to human existence.

7. Describe the lichens and their importance to humans.

Assignments: Read text. Review text summaries and questions.

COURSE CONTENT(CONTINUED):

LECTURE CONTENT(CONTINUED):

3 LECTURE HOURS

Lecture Objectives:

1. Compare and contrast the Plant Kingdom with other kingdoms.
2. Differentiate the bryophytes from other plants.
3. Describe the liverworts and differentiate between leafy and thalloid liverworts.
4. Describe the hornworts.
5. Describe the mosses.
6. Discuss reproduction and life cycles of liverworts, hornworts, and mosses.
7. Discuss the importance of the bryophytes to humans.
8. Compare and contrast the structure of bryophytes and vascular plants.
9. Describe the seedless vascular plants: whisk ferns, club mosses and quillworts, horsetails and scouring rushes, and ferns.
10. Discuss reproduction and life cycles of whisk ferns, club mosses and quillworts, horsetails and scouring rushes, and ferns.
11. Discuss the human relevance of the seedless vascular plants.
12. Discuss the evolutionary relationships between the different groups of plants, including bryophytes, seedless vascular plants, gymnosperms, and angiosperms.
13. Describe fossils and petrifications and their significance.

Assignments: Read text. Review text summaries and questions in preparation for exam.

4 LECTURE HOURS

Lecture Objectives:

1. Discuss the evolution of seed plants.
2. Describe the features of typical conifer pollen and seed strobili.
3 Differentiate between the major gymnosperm phyla.
4. Describe pine leaf adaptations.
5. Describe reproduction and life cycles in gymnosperms.
6. Discuss the human relevance of the conifers. and other gymnosperms.
7. Discuss the evolution of the angiosperms.
8. Compare and contrast the gymnosperms and angiosperms.
9. Describe the life cycle of the flowering plant.
10. Compare and contrast the development of the two types of female gametophytes and the male gametophyte.
11. Relate flower characteristics and pollinators to their evolution and ecology.
12. Discuss major trends of specialization in flowering plants.
13. Discuss the importance of herbaria, and describe techniques used in preparation of herbarium specimens.
14. Discuss the origin of cultivated plants.
15. Describe the distribution of cultivated plants.
16. Describe the ten families of flowering plants.
17. Discuss the roles of angiosperms in human existence.

Assignments: Read text. Review text summaries and questions in preparation for final.

2 LECTURE HOURS

Lecture Final

COURSE CONTENT(CONTINUED):

LAB CONTENT:

3 LAB HOURS

Lab Objectives:

1. Discuss correct drawing techniques for lab reports.
2. Describe general practices to be used in lab.

Assignments: Read text. Attend lab discussion. Review text summaries and questions.

3 LAB HOURS

Lab Objectives:

1. Identify and discuss the functions of the parts of the light microscope.
2. Compare and contrast the compound and dissecting microscope, as well as other types of microscopes.
3. Define: resolution, microscopic field, depth of field.
4. Calculate total magnification.

Assignments: Read text. Review text summaries and questions. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Identify components of plant cells that can be observed using the light microscope.
2. Compare and contrast cyclosis (cytoplasmic streaming) and independent cellular motility.
3. Describe and identify the events of the phases of mitosis.
4. Discuss the structure and function of structures associated with mitosis.

Assignments: Read text. Review text summaries and questions. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Describe and identify the phases of meiosis.
2. Discuss and identify gametophyte and sporophyte phases of plant life cycles.
3. Identify tissues as haploid or diploid.

Assignments: Read text. Review text summaries and questions in preparation for quiz. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Identify and differentiate between root hairs and lateral roots.
2. Identify and discuss the functions of epidermis, pericycle, cortex,
endodermis, pericycle, stele, phloem, xylem, and casparian strips.
3. Compare and contrast dicot and monocot roots.

3 LAB HOURS

Lab Objectives:

1. Perform and discuss basic techniques of plant propagation using stems, roots and leaves.
2. Perform and discuss bud grafting.
3. Perform and discuss propagation of seed embryos on artificial media.
4. Discuss the importance of sterile techniques in plant propagation on sterile media.

Assignments: Read text. Review text summaries and questions. Complete lab report.

COURSE CONTENT(CONTINUED):

LAB CONTENT(CONTINUED):

3 LAB HOURS

Lab Objectives:

1. List and describe the parts of a woody stem during its winter condition.

2. In various stems, identify and discuss the function of: cork, cork cambium,

epidermis, phelloderm, cortex, primary phloem, secondary phloem,

vacular cambium, primary xylem, secondary xylem, broad and narrow phloem rays,

broad and narrow xylem rays, tracheids, vessels, annual xylem rings, pith.

3. Compare and contrast monocot and dicot stems.

Assignments: Read text. Review text summaries and questions in preparation for exam. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Perform and discuss basic techniques of plant propagation using stems, roots and leaves.

2. Perform and discuss bud grafting.

3. Perform and discuss propagation of seed embryos on artificial media.

4. Discuss the importance of sterile techniques in plant propagation on sterile media.

Assignments: Read text. Review text summaries and questions. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Describe and discuss the effects of auxins and gibberellins on stem growth.

2. Describe phototropism and gravitropism and discuss their causes.

3. Describe etiololation and its causes.

4. Describe and discuss the effects of ethylene on abscission.

Assignments: Read text. Review text summaries and questions in preparation for quiz. Complete lab report.

6 LAB HOURS

Lab Objectives:

1. Describe techniques for the demonstration of starch in plants. Discuss the relationship between starch and photosynthesis.

2. Discuss the relationship between chlorophyll and photosynthesis.

3. Describe techniques for the solvent extraction of plant pigments.

4.Describe the technique of paper chromatography and how it can be used to demonstrate plant pigments.

5. Define the term fluorescence and demonstrate fluorescence in photosynthetic pigments.

6. Discuss the use of phenol red a pH indicator.

7. Discuss the formation of acid from carbon dioxide and water, and this reaction can be used to

demonstrate the use of carbon dioxide in photosynthesis.

Assignments: Read text. Review text summaries and questions in preparation for exam. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Identify plant cells in the different phases of meiosis.

2. Compare and contrast the processes of mitosis and meiosis.

3. Define the terms sporophyte and gametophyte, and relate these terms to the process of sexual reproduction in plants.

4. Compare life cycles in plants to life cycles in animals.

Assignments: Read text. Review text summaries and questions. Complete lab report.

COURSE CONTENT(CONTINUED):

LAB CONTENT(CONTINUED):

3 LAB HOURS

Lab Objectives:

1. Observe plants in their natural setting.
2. Identify adaptations of chapparal plants to a Mediterranean climate.

Assignments: Read text. Review text summaries and questions. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Observe examples of members of the different taxonomic groupings discussed in lecture.
2. Define the terms gram positive and Gram negative.
3. Identify select structures of various cyanobacteria and protists.

Assignments: Read text. Review text summaries and questions in preparation for quiz. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Observe various examples of fungi.
2. Identify various reproductive structures of fungi.
3. Observe examples of bryophytes and ferns.
4. Describe the life cycles of mosses, ferns, and liverworts.

Assignments: Read text. Review text summaries and questions. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Observe examples of selected gymnosperms.
2. Compare and contrast selected gymnosperm leaves.
3. Discuss the life cycle of a gymnosperm.
4. Differentiate between male and female pine cones.
5. Identify various structures of pine cones, pine seeds, and pine pollen grains.
6. Distinguish between pines, cycads, and other gymnosperms.

Assignments: Read text. Review text summaries and questions in preparation for exam. Complete lab report.

3 LAB HOURS

Lab Objectives:

1. Identify the parts of a complete flower.
2. Discuss variations in ovary position and structure.
3. Describe the life cycle of a flowering plant.

Assignments: Complete lab report.

3 LAB HOURS

Lab Final

METHODS OF INSTRUCTION:

Lecture presentation and Laboratory exposure to practical application. Use of computer, internet, video, document camera, board notes, 'outdoor classroom' projects, Service Learning, discussion, and presentations from biological professionals. A variety of assessment techniques that include lecture examinations, experimental projects, homework problems, laboratory reports, research reports, and laboratory practicums.

OUT OF CLASS ASSIGNMENTS:

Required Outside Hours: 108

Assignment Description:

Homework, Lab reports, Greenhouse upkeep, Service Learning Assignments (Arboretum, Meadow, Native Garden and volunteerism at local non-profit nature focus organizations)

METHODS OF EVALUATION:

Writing assignments

Percent of total grade: 10.00 %

Percent range of total grade: 10 % to 20 % Written Homework Lab Reports Essay Exams Term or Other Papers

Problem-solving assignments

Percent of total grade: 35.00 %

Percent range of total grade: 35 % to 40 % Homework Problems Field Work Lab Reports Quizzes Exams Other: service learning

Skill demonstrations

Percent of total grade: 10.00 %

Percent range of total grade: 10 % to 20 % Class Performance/s Field Work

Objective examinations

Percent of total grade: 30.00 %

Percent range of total grade: 30 % to 45 % Multiple Choice True/False Matching Items Completion Other: Essay

REPRESENTATIVE TEXTBOOKS:

Lisa A. Urry; Michael L. Cain; Steven A. Wasserman; Peter V. Minorsky; Rebecca Orr. Campbell Biology. United States: Pearson,2021.

The need for a more recent text. The need to have a text with more online resources and support. The need for a text that will pair well with a lab textbook (Mylab Pearson publishing) Campbell Biology is the standard bearer for introductory college-level biology for majors. This is also the required text for the first course (Bio 1) in this sequence.

ISBN: 9780135855836

Reading Level of Text, Grade: 17 Verified by: D. Young

Required Other Texts and Materials

A Photographic Atlas for the Botany Laboratory, 7e By: Samuel R. Rushforth, Robert R. Robbins, John L. Crawley, Kent M. Van De Graaff Copyright: ?2016

Evert, Eichhorn, Perry. Laboratory Topics in Botany, 8e. W.H. Freeman. 2013. ISBN 978-1464118104.

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:
- GAV B2
- GAV B3
- GAV Area 4 = Social & Behavior

CSU GE:
- CSU B2
- CSU B3

IGETC:
- IGETC 5B
- IGETC 5C

CSU TRANSFER:
- Transferable CSU

UC TRANSFER:
- Transferable UC

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN: BIOL6
CAN Sequence: BIOL SEQ A
C-ID: (BIOL 155)
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Course Control Number: CCC000250366
Sports/Physical Education Course: N
Taxonomy of Program: 040200