**Agricultural Biology**

## Jurupa Valley HS

**Meets the UC “d” Admission Requirement**

**I. COURSE INFORMATION:**

Course Title: Agricultural Biology

Credits: 10 Units

Length of Course: 1 Year

Prerequisites: Algebra I or concurrent enrollment in Algebra I

Target Group: Students with ninth grade honors or GATE only and tenth through twelfth grade students who plan to enter a college and/or university with a major in agriculture. This is an elective course that meets life science graduation requirements and departmental major requirements, as well as University of California one-year laboratory science admission requirements.

**II. COURSE GOALS:**

A. Agricultural Biology is a laboratory science course designed for the college-bound student. The course emphasizes detailed knowledge of the biological principles of the following areas: molecular and cellular aspects of living things, structure and function of agricultural plants and animals, genetics, physiology, plant and animal diversity and principles of classification, ecological relationships, and animal behavior.

1. Specific goals include:
2. To learn the nature of scientific inquiry and incorporate the use of the scientific method in laboratory investigations that pertain to biological and agricultural principles.
3. To be familiar with the theory of cell biology and its application to the organization of all living organisms.
4. To identify and understand the processes of cellular and organism growth and reproduction.
5. To recognize the diversity of life and the interrelationships among all organisms.
6. To understand the role of genetics in organism variation and adaptation.
7. To understand the role of genetics as it pertains to the development of multicellular organisms and appreciate how encoded genes specify the characteristics of living organisms.
8. To acquire biological and agricultural research vocabulary, and the reading, writing, and critical thinking skills pertaining to scientific inquiry.
9. To understand the stability in an ecosystem is a balance between competing effects.
10. To understand fundamental cellular and systemic functions and processes.
11. To recognize the interrelationships between biotic and physical factors to energy flow in the biosphere.

**III. COURSE OBJECTIVES:**

A. Students should be able to:

1. Intelligently discuss theories on the origins of life.
2. Describe the characteristics of living organisms.
3. Describe the characteristics of plant and animal cells with respect to their structure and chemistry.
4. Compare and contrast the roles of meiosis and mitosis in cellular and organism reproduction.
5. Define the chromosome theory of heredity, Mendelian genetics, gene-enzyme relationships, and apply this knowledge to animal inheritance.
6. Distinguish between historical and modern taxonomy systems and scientific nomenclature that demonstrate evolutionary relationships among plants and animals.
7. Identify the structural and functional similarities and differences among the major animal, plant, and protist phyla.
8. Analyze the major organ systems of animals and understand their function.
9. Recognize the structure and function of ecosystems, populations, and communities, and the impact of human society on the natural and agricultural environment.
10. Describe the three cycles that involve biotic and abiotic factors: nitrogen, carbon-oxygen, and water; and explain the importance of their interrelationships to the biosphere.
11. Identify the environmental and genetic factors that influence variation among organisms.
12. Demonstrate basic laboratory techniques including the use of microscopes, microscope slide preparation, maintenance and examination of micro-organism cultures, tests demonstrating fundamental biochemical reactions, dissection of representatives of plant and animal phyla, and the sharpening of interpretative skills.

**IV. COURSE OUTLINE:**

A. Introduction to Agricultural Biology

1. What is Agricultural Biology and its Importance
2. Research Uses of Agricultural Biology
3. The Scientific Method
4. The Metric System

B. Organisms and Their Ecological Environment

* 1. Biodiversity
  2. Conserving Natural Resources
  3. Agricultural Practices Beneficial and Harmful to the Environment
  4. The Ecosystem and Population Fluctuations
  5. The Nitrogen Cycle
  6. The Oxygen Cycle
  7. The Food Wed

C. Cell Biology

1. Plant and Animal Cell Identification and Functions

2. Plant and Animal Cell Structure and Functions

3. Cellular Respiration

4. Cellular Transport

1. Cell Differentiation
2. Chemiosmotic Gradients and ATP Production
3. Macromoecules in Cells

D. Inorganic Foundations that Support Life

1. Soil and Water: The Chemical Foundation
2. Atomic and molecular structure and chemical bonding
3. Basic Soil Components
4. Soil Formation Factors and Horizons
5. Soil Texture and Structure
6. Soil Organisms and Organic Matter
7. Interrelationships of Plants and Soil
8. Water Movement Properties
9. Soil and Water Management

E. Plant & Animal Classifications

1. Development of the Binomial System of Nomenclature
2. Classifications of Major Groups of Plants and Animals
3. Evolutionary Relationships
4. Development of the Kingdom Concept
5. Comparisons of Modern Agricultural Plants and Animals

F. Plant Physiology, Reproduction, Photosynthesis and Growth

1. Plant Structures & the Process of Photosynthesis
2. Plant Growth Requirements
3. Monocotyledons and Dicotyledons
4. Sexual and Asexual Reproduction
5. Research Applications to Plant Biotechnology
6. Chemical and Environmental Factors Affecting Plant Growth

G. Animal Physiology and Reproduction

1. Internal Systems of Animals
2. The Digestive Process
3. The Respiratory System

4. The Reproductive System

5. The Circulatory System

6. The Endocrine System

7. The Nervous System

8. The Immune System

H. Animal Nutrition

1. Feed Identification and Nutrient Evaluation
2. Feed Additives
3. Ration Formulation
4. Animal Nutrient Requirements
5. Vitamin and Amino Acid Requirements
6. Nutritional Diseases

I. Animal Health & Diseases

1. Disease Agents
2. Causes of Disease
3. Infectious and Noninfectious Diseases
4. Animal Health Practices
5. Common Internal & External Parasites Lifecycles

J. Plant and Animal Genetics

1. Heritability and Genetic Traits
2. Dominant and Recessive Genes
3. Genotype and Phenotype
4. Cellular Reproduction: Mitosis and Meiosis
5. Physical and Chemical Structures Involved in Genetics
6. DNA and Types of DNA
7. DNA Replication
8. Mendel – Independent Assortment and Segregation
9. Biotechnology and Cloning
10. Proteins and RNA
11. Role and Function of Amino Acids in Genetics
12. Mutation and Sexual Reproduction

K. Agricultural Biology Research Project

1. Development and Formulation of Agriscience/Science Fair Project

2. Research Principles & Design

3. Statistical Management & Analysis of Agriscience/Science Fair Project

1. Instructional Supervision & Coordination

L. Leadership & Team Building Development

1. Oral and speaking presentations
2. Critical Thinking Exercises
3. Problem Solving Exercises

**V. TEXTS & SUPPLEMENTAL INSTRUCTIONAL MATERIALS:**

Modern Biology 2nd Edition (Holt, Rinehart & Winston, 2000)

Laboratory Investigations in Biology (Holt, Rinehart & Winston, 2000)

Biological Science Applications in Agriculture (Osborne, 1999)

Agriculture Biology Lab Manual Revised (Fullerton, 1999)

## VI. KEY ASSIGNMENTS:

1. Weekly Reading & Writing Assignments
2. Weekly laboratory activities & write-ups
3. Agriculture Biology Term Paper
4. Supervised Agricultural Experience Project & Record Book
5. Student Seminar Presentation related to Agriculture Biology Topic
6. Portfolio of Laboratory Exercises
7. Leadership Development Activities

**VII. INSTRUCTIONAL METHODS:**

A. Students will be engaged in a variety of activities that balance direct instruction with project work. Students will be expected to apply the academic and applied concepts and processes learned during direct instruction to their projects. Students will attend lectures, complete labs, become involved with professional mentors, complete real world projects, and make presentations that demonstrate understanding of physical concepts and the application process.

B. Methods of instruction will include, but is not limited to:

1. Direct instruction (lectures, discussions, readings, and lab activities specific for mastery of content).

2. Use of community-based research projects and with professional mentors, development of language arts skills while students complete reports, journals, analyses, and essays.

3. Use of a variety of instructional materials and resources including electronic media, handbooks, professional journals, reference materials, and textbooks.

4. Self-directed, cooperative, and collaborative learning opportunities to increase responsibility of students for their own learning.

5. Use of student presentations, exhibits, and competitions.

**VIII. ASSESSMENT METHODS:**

A. Assessment opportunities that allow continuous evaluation of students' progress should be embedded throughout the course and should be a learning experience. All students will be expected to achieve a high understanding of all topics; often demonstration of knowledge will occur in a public forum. The following strategies, which include both formal and informal assessment techniques, may include, but are not limited to:

1. Performance-based assessments such as demonstrations, discussions, simulations, and projects

2. Presentations, (both team and individual) written assignments, (both team and individual),

3. On-going and cumulative portfolio of investigative accomplishments.

4. Written tests & quizzes with a variety of short answer and essay questions.

5. Written assignments, (such as justifications, investigations, and research, evaluative, or technical), and individual and group assessments including the assessment working relationships.

B. Grading will be based on the following assessment areas:

1. Tests & Quizzes 40%

2. Laboratory Investigation Activities & Write-ups 20%

3. Portfolio & Writing Assignments 15%

4. Leadership & Critical Thinking Activities 10%

5. Research Report and Oral Presentation 10%

6. Supervised Agricultural Experience & Record Book 05%

**IX. LABORATORY ACTIVITIES:**

A. The Scientific Method

B. Analyzing Ecosystems

C. Checking water for Coliform Bacteria

D. Genotypic and phenotypic ratios

E. Cell identification

F. Flower dissection and pollen growth germination

G. Secondary and microelements with N-P-K tissue tests on plants

H. Animal tract dissection

I. Reproductive tract dissection

J. Feed nutrient analysis

K. Factors affecting photosynthesis

L. Effects of leaf surface area, air movement, and light on transpiration rates

1. Effects of light quality on plant growth
2. Artificial insemination & embryo transfer
3. Phototropism
4. The Hydrologic Cycle
5. Comparison of soil vs. non-soil plant culture
6. Effects of nutrient concentrations on hydroponic plant growth
7. Effects of chemicals (herbicides) on plants
8. Herbicide biopsy
9. Effects of rooting hormone on root development
10. Balancing feed rations
11. Anther culture
12. DNA extraction
13. Probability of trait inheritance
14. Tissue culture
15. Seed disperal
16. Genetic probability
17. Insect identification
18. Environmental forcing structures
19. Comparison of asexual propagation methods
20. Water quality
21. Plant pigment chromatography