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

**BIO 101 Biological Principles**

**Prerequisite:** Satisfactory completion of MATH 90 or qualification by the MJC assessment process.

**Corequisite:** or satisfactory completion of Concurrent enrollment in or satisfactory completion of CHEM 101.

Study of general principles of biology in relationship to the processes of all living organisms. Topics include an introduction to the nature of science, reproduction, development, evolution, energetics, molecular biology, genetics, cellular structure, homeostatic mechanisms, ecology and taxonomy. Core course intended for biology and biology-related majors.

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. Scientific method
      ii. Characteristics of life
      iii. Origin of life
      iv. Evolution of early life forms
   b. Biological molecules
      i. Proteins
         a. Enzymes
         b. Structural proteins
      ii. Hormones
      iii. Carbohydrates
      iv. Lipids
      v. Nucleic acids
   c. Cellular biology
i. Organelles
ii. Surface area/volume ratio
iii. Membrane systems of the cell
iv. Eukaryotic and prokaryotic cells
v. Signaling between cells/cell surface receptors
vi. Allosteric proteins

d. Energetics
i. Energy
ii. Photosynthesis
iii. Respiration (aerobic and anaerobic)
iv. ATP generation (chemiosmotic coupling hypothesis)

e. Reproduction
i. Mitosis
ii. Meiosis
iii. Reproductive strategies

f. Transmission genetics
i. Mendelian genetics
ii. Chromosomal inheritance
iii. Interaction of genes
iv. Linkage, recombination and genetic mapping
v. Human genetics/eugenics

g. Molecular basis for heredity (Molecular Genetics)
i. DNA as genetic material
ii. Replication and mutation of DNA
iii. Genes and enzymes
iv. Protein synthesis and regulation in eukaryotic and prokaryotic cells
v. Recombinant DNA technology
vi. Human genetics
vii. Structure and expression of genes
viii. RNA splicing and transcription
ix. Gene regulation in eukaryotic and prokaryotic cells

h. Development
   i. Fertilization

i. Evolution
   i. Natural selection
   ii. Adaptation
   iii. Speciation
   iv. Population genetics and evolution
   v. Phylogenetic relationships
   vi. Principles of taxonomy and taxonomic system

j. Ecology
   i. Ecosystems
   ii. Trophic levels
   iii. Community structure
   iv. Biogeochemical cycles
   v. Succession
   vi. Interactions between populations
   vii. Human interaction with the environment

k. Homeostasis
   i. Cells, tissues, organs, organ systems (animal and plant)
   ii. Water regulation
   iii. Temperature regulation
   iv. Nervous and hormonal integration
   v. Gas exchange
   vi. Transport
   vii. Modes of nutrition
   viii. Waste management

2. Required Lab Content:
a. Introduction
   i. Apply scientific method

b. Biological molecules
   i. Purify proteins
   ii. Determine the physical and chemical nature of enzymes
   iii. Describe the role hormones play in plant development
   iv. Isolate, purify and quantify nucleic acids

c. Cellular biology
   i. Describe the effects molecular concentration, size, and temperature has on movement of molecules across a membrane
   ii. View and describe differences between eukaryotic and prokaryotic cells

d. Energetics
   i. Perform experiments in cellular respiration
   ii. Isolate and identify Photosynthetic compounds

e. Reproduction
   i. Identify male and female reproductive tissues and cells

f. Mitosis
   i. Identify and describe the phases of mitosis

g. Meiosis
   i. Identify and describe the phases of meiosis
   ii. Compare and contrast mitosis and meiosis

h. Transmission genetics
   i. Isolate DNA and determine a family lineage using fingerprinting analysis

B. ENROLLMENT RESTRICTIONS

1. Prerequisites
   Satisfactory completion of MATH 90 or qualification by the MJC assessment process.

2. Co-requisites
   Concurrent enrollment in or satisfactory completion of CHEM 101.
3. **Requisite Skills**  
*Before entering the course, the student will be able to:*

a. Identify and apply the vocabulary and basic principles of introductory chemistry.

b. Demonstrate the ability to evaluate data within the context of physical and chemical concepts.

c. Solve chemical problems using unit conversions.

d. Determine the nature and polarity of chemical bonds.

e. Correlate electron structure to oxidation number and chemical bonds.

f. Determine acidity and alkalinity using the pH scale.

C. **HOURS AND UNITS**

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<th>INST METHOD</th>
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<th>UNITS</th>
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<tr>
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D. **METHODS OF INSTRUCTION (TYPICAL)**  
*Instructors of the course might conduct the course using the following method:*

1. Lecture

2. Class discussion

3. Laboratory experience

4. Field trips

5. Films and video clips

E. **ASSIGNMENTS (TYPICAL)**

1. **EVIDENCE OF APPROPRIATE WORKLOAD FOR COURSE UNITS**  
*Time spent on coursework in addition to hours of instruction (lecture hours)*

a. Daily reading assignments with a worksheet to be handed in for evaluation.

b. Current event written report.

c. Environmental awareness research and poster presentation.

2. **EVIDENCE OF CRITICAL THINKING**  
*Assignments require the appropriate level of critical thinking*

a. Reading homework:

i. Describe how an elevator in a building is similar to an enzyme. Include activation energy, substrate binding site, substrate, and product in your description.

ii. Explain how dinosaurs and fossil fuels can be used to support the first and second laws of thermodynamics.

iii. Draw a eukaryotic cell, identify the organelles, and state their function.
b. Current Event:
   i. Using a science news article from a local paper, illustrate your understanding of one
      biological principle covered in this course.

c. Exam Question:
   i. Given data, determine the size of the DNA fragments in each lane.
   ii. Describe how the appearance of an electrophoresis gel would appear if the DNA is
       accidentally loaded near the positive electrode.

F. TEXTS AND OTHER READINGS (TYPICAL)

      Pearsons.

III. DESIRED LEARNING

A. COURSE GOAL
   As a result of satisfactory completion of this course, the student should be prepared to:

   apply the scientific method, utilize laboratory equipment, analyze data, and effectively communicate
   findings when given biological based questions. In addition, students will be prepared to transfer to a CSU
   or UC as a biology major.

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. organize and interpret data from scientific experiments in biology and formulate conclusions.
      b. analyze the role of biological science in society.
      c. distinguish between generalizations and principles, theories and laws, science and
         pseudoscience.
      d. define the characteristics that distinguish living from non-living things.
      e. apply the scientific methodology of investigation.
      f. describe the structure, function and relationships of DNA, RNA and proteins in living systems.
      g. describe the process of protein synthesis and its regulations as it occurs in eukaryotic and
         prokaryotic organisms.
      h. summarize the historical basis for biological principles and relate current research to these
         principles.
      i. explain the process of evolution in relation to the diversity of life.
      j. relate chemical and physical reactions to the processes of life.
k. describe how the processes of adaptation and natural selection are illustrated at the molecular, cellular, organismal and population level.

l. analyze the interrelationship of the organism to the abiotic and biotic aspects of the environment.

m. describe hierarchical levels of organization ranging from atoms to the biosphere.

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. interpret evidence regarding the origin of life.

2. **Lab Learning Goals**

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

   a. prepare formal laboratory reports generated from laboratory experiments.

   b. prepare labeled laboratory drawings to scale.

   c. demonstrate proficiency with laboratory equipment, procedures and dissection.

   d. analyze an environmental issue and describe how society contributes to it.

   e. determine the physical and chemical environment required for optimal enzyme function in living systems.

   f. describe how changes to DNA may or may not alter protein structure in eukaryotic and prokaryotic organisms.

   g. describe homeostatic mechanisms of living organisms.

   h. genetically engineer E.coli and analyze the influence of biotechnology on society.

   i. generate an action spectrum and standard curve to determine the concentration of a biological substance in solution

   j. separate a mixture of biological molecules into fractions of pure substances using column chromatography, gel electrophoresis, and paper chromatography

   k. isolate and purify DNA from animal or plant tissue.

   l. quantify DNA and proteins using spectrophotometry

   m. perform plant tissue culture and describe the role hormones play on plant development.

   n. utilize a light and/or dissecting microscope and calculate the total magnification and size of object being viewed.

   o. identify and label a variety of human tissues and cell types.

   p. perform a DNA fingerprinting and analyze the data obtained.
IV. METHODS OF ASSESSMENT (TYPICAL)

A. FORMATIVE ASSESSMENT

1. Laboratory reports
2. Problem-solving exercises
3. Lecture exams
4. Laboratory exams

B. SUMMATIVE ASSESSMENT

1. Comprehensive final exam