



**CREDIT COURSE OUTLINE**

**I. COVER PAGE**

(1) BIOL 31	(2) MICROBIOLOGY	(3) 5
Number	Title	Units

<table border="1" style="width:100%"> <tr> <td colspan="3">(4) Lecture / Lab Hours:</td> </tr> <tr> <td colspan="3">Total Course Hours</td> </tr> <tr> <td>Total Lec hours:</td> <td></td> <td align="right">54.00</td> </tr> <tr> <td>Total Lab hours:</td> <td></td> <td align="right">108.00</td> </tr> <tr> <td>Total Contact hours:</td> <td></td> <td align="right">306.00</td> </tr> <tr> <td colspan="3">Lec will generate <u>0</u> hour(s) outside work.</td> </tr> <tr> <td colspan="3">Lab will generate <u>0</u> hour(s) outside work.</td> </tr> <tr> <td>(5) Grading Basis:</td> <td>Grading Scale Only</td> <td align="center">X</td> </tr> <tr> <td></td> <td>Pass/No Pass option</td> <td></td> </tr> <tr> <td></td> <td>Pass/No Pass only</td> <td></td> </tr> <tr> <td colspan="3">(6) Advisories:</td> </tr> <tr> <td colspan="3">Eligibility for Math 101</td> </tr> <tr> <td colspan="3">Eligibility for English 126</td> </tr> <tr> <td colspan="3">Eligibility for English 125</td> </tr> <tr> <td colspan="3">(7) Pre-requisites(requires C grade or better):</td> </tr> <tr> <td colspan="3">BIOL 1 , or</td> </tr> <tr> <td colspan="3">BIOL 5 , or</td> </tr> <tr> <td colspan="3">BIOL 11B</td> </tr> <tr> <td colspan="3">Corequisites:</td> </tr> </table>	(4) Lecture / Lab Hours:			Total Course Hours			Total Lec hours:		54.00	Total Lab hours:		108.00	Total Contact hours:		306.00	Lec will generate <u>0</u> hour(s) outside work.			Lab will generate <u>0</u> hour(s) outside work.			(5) Grading Basis:	Grading Scale Only	X		Pass/No Pass option			Pass/No Pass only		(6) Advisories:			Eligibility for Math 101			Eligibility for English 126			Eligibility for English 125			(7) Pre-requisites(requires C grade or better):			BIOL 1 , or			BIOL 5 , or			BIOL 11B			Corequisites:			<table border="1" style="width:100%"> <tr> <td colspan="3">(8)Classification:</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>Degree applicable:</td> <td align="center">X</td> </tr> <tr> <td></td> <td>Non-degree applicable:</td> <td></td> </tr> <tr> <td></td> <td>Basic skills:</td> <td></td> </tr> <tr> <td>(9)RC</td> <td>Fulfills AS/AA degree requirement: (area)</td> <td></td> </tr> <tr> <td></td> <td>General education category:</td> <td></td> </tr> <tr> <td></td> <td>Area A Natural Sciences</td> <td></td> </tr> <tr> <td></td> <td>Major:</td> <td align="center">BIOLOGICAL SCIENCE</td> </tr> <tr> <td></td> <td>Certificate of:</td> <td></td> </tr> <tr> <td></td> <td>Certificate in:</td> <td></td> </tr> <tr> <td>(10)CSU</td> <td>Baccalaureate:</td> <td align="center">X</td> </tr> <tr> <td>(11)Repeatable: (A course may be repeated three times)</td> <td></td> <td align="center">0</td> </tr> </table>	(8)Classification:							Degree applicable:	X		Non-degree applicable:			Basic skills:		(9)RC	Fulfills AS/AA degree requirement: (area)			General education category:			Area A Natural Sciences			Major:	BIOLOGICAL SCIENCE		Certificate of:			Certificate in:		(10)CSU	Baccalaureate:	X	(11)Repeatable: (A course may be repeated three times)		0
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(12) Catalog Description: This course provides an introduction to the structure, metabolism and ecology of microorganisms with special emphasis on microbe-related human diseases. This course is designed to introduce the student to a variety of topics in the area of microbiology. The text, lab manuals, and lectures are geared to students in biological, medical, physical education and health-oriented programs.
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**II. COURSE OUTCOMES:**

*(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)*

Upon completion of this course, students will be able to:

- I. perform basic staining and identification techniques allowing them to perform basic identification procedures (i.e., gram stains).
- II. understand and be able to log genus, species, type of organism, whether it is considered normal flora or not, and its potential as a pathogen.
- III. perform labs which hone critical thinking skills, for example: antibiotic susceptibility allows them to understand that some organisms can be controlled by chemicals and others cannot. In the clinical setting they will be able to evaluate a susceptibility test and understand the effect of certain drugs on specific microorganisms.
- IV. understand and diagram the schematics and working of an autoclave, mechanics of a microscope, inoculation of sterile agar plates, and identification of microorganisms with biochemical testing

**III. COURSE OBJECTIVES:**

*(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)*

In the process of completing this course, students will:

- I. identify the basic structure, metabolism and ecology of a variety of microorganisms (viruses; bacteria; fungal, protozoan, and helminth parasites) which in turn, will allow them to better understand how these microbes function in their specific environments.
- II. learn how some microorganisms are beneficial to mankind while others cause a variety of human diseases.
- III. develop important critical thinking skills as they evaluate the results of laboratory experiments and demonstrations.
- IV. learn to use the scientific method and be able to evaluate a variety of laboratory experiments (such as Identification of Unknowns, Biochemical Tests, Temperature Effects on Growth, Antibiotic Sensitivity).
- V. develop important manual dexterity skills associated with operation of technical laboratory equipment (microscope, autoclave, agar plates, sterile technique apparatus, Enterotubes).

#### IV. COURSE OUTLINE:

##### Lecture Content:

##### A. Introduction to Microbiology- Historical vs Present attitude toward disease.

1. Brightfield Microscopy
2. Phase-Contrast Microscopy
3. Microscopic Measurements

##### B. Biochemistry

1. Four macromolecules of microorganisms: structure and function
2. Growth Factors of Microorganisms – including molecular oxygen , inorganic factors and organic factors.
3. Mechanism of aerobes, microaerophiles, facultative anaerobes, and obligate anaerobes.
4. DNA mechanisms of bacterial reproduction: binary fission, transformation, conjugation and transduction.

##### C. Microscopy

1. Negative Staining
2. Smear Preparation
3. Simple Staining
4. Capsular Staining
5. Gram Staining
6. Spore Stains (2)
7. Acid-Fast Staining

##### D. Prokaryotic versus Eucaryotic Cells

1. Motility Determination
2. Identification methodology currently used in the clinical setting.

##### Section 2

##### A. Classification

1. Viruses: Classification, Mutant Capabilities, and Disease Routes
2. Bacteria, Cyanobacteria
3. Morphology Unknown + Computer ID

##### B. Other Microorganisms

1. Protozoa – Classification and the separation of free living vs parasitic protozoans  
4 classes of human pathogens
2. Algae – structure and function; importance to humans

##### C. Microscopic Invertebrates- other possible pathogens

##### D. Soil and water Microbiology

1. Environmental Cultures
2. Reclamation of water and its potability
3. Wastewater Treatment Plants in California: general plan and function

##### E. Food and Industrial Microbiology

1. Yeasts and Molds: Shelf life of food and preservation. Hypertonic, Isotonic and Hypotonic environments.
2. Water Examination: Membrane Filter Method, Direct Examination, and Culture for Coliforms.

##### Section 3

##### A. Culture Media Preparation: agar, broth, and slants.

##### B. Pure Culture Techniques: Streak Plate

##### C. Cultural Characteristics: Each genus and species has its own characteristics.

##### D. Microbial Metabolism

1. Physiological Characteristics:
  - a. Biooxidations, Hydrolysis, Oxidation-Reduction Reactions.
  - b. OF Glucose
  - c. Strain differentiation and DNA tests

##### E. Microbial Growth

1. Temperature: Effects on Growth, Lethal Effects
2. Osmotic Pressure and Bacterial Growth

##### F. Control of Microbial Growth

1. pH and Microbial Growth

2. UV Light: lethal Effects
3. Antimicrobial Drugs
4. Disinfectants and Antiseptics: Evaluation
5. Antimicrobial Sensitivity Testing

#### Section 4

- A. Principles of Disease and Epidemiology: Mode of transmission, dose, and degree of Pathogenicity.
- B. Gram negative Intestinal Pathogens (Unknowns #2)
  1. Use of Bergey's Manual + computer
  2. Enterobacteriaceae ID: The Enterotube II System
- C. Mechanisms of Pathogenicity: antimicrobial resistance, mutations, and new strains.
- D. Oral Reports of Selected Diseases
- E. Nonspecific Defenses of the Host- Phagocytosis, the skin as a mechanical barrier, and natural defenses.
- F. Specific Defenses of the Host: The Immune Response: B and T cell roles in immunity.
- G. Harmful Aspects of the Immune Response (autoimmune disorders)

#### **Lab Content:**

- A. Microscopy
- B. Aseptic Transfer and Safety
- C. Viewing Live Organisms
- D. Microscopic Measurements
- E. Staining
- F. Environmental Organisms
- G. Aseptic Transfer of Bacteria
- H. Isolation of Bacteria by Dilution
- I. Carbohydrate Catabolism
- J. Fermentation of Carbohydrates
- K. Differential/Selective Media
- L. DNA Spooling and Isolation
- M. Protein Metabolism
- N. Respiration
- O. Oxygen Requirements
- P. PH and Osmotic Pressure Effects on Bacteria
- Q. Physical Methods of Control: Heat, UV Radiation
- R. Disinfectants and Antiseptics
- S. Antimicrobial Drugs
- T. Hand Washing
- U. Yeast and Molds
- V. Protozoans
- W. Normal Flora of Mouth, Throat, & Skin
- X. Unknowns

#### V. APPROPRIATE READINGS

***Reading assignments may include but are not limited to the following:***

- I. Sample Text Title:
  1. Recommended - Tortora *Microbiology*, ed. 10th Benjamin Cummings Pub. Co., 2010,
  2. Recommended - Johnson & Case *Lab Experiments in Microbiology- Symbiosis*, ed. 7th Benjamin Cummings Pub. Co., 2007,
- II. Other Readings

- Global or international materials or concepts are appropriately included in this course
- Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

Microbiology includes a historical component as a look at the field of microbiology. The influence has been worldwide from Jenner and vaccines to Pasteur and fermentation. This course delves into DNA recombinant technology and its application on worldwide issues. For example: oil spills and their microbiological clean-up, genetically manipulated bacteria, their uses and importance, the new branches of microbiology that are affecting us worldwide like immunology and virology (AIDS and EBOLA). Another worldwide component is the antibiotic resistance of microorganisms and how it is affecting patient care. In the microbiology of water, we study reclamation and the current worldwide shortage of fresh drinking water. Students go to a wastewater treatment plant to learn about the technology of water versus the water shortage in other countries. Our last international component is Bioterrorism. Our students learn about the different genera that can be airborne, are capable of mass destruction, and their effect on the human as a host.

**VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:**

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

<b>A. Writing</b>			
Check either 1 or 2 below			
X	<b>1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.</b>		
	<b>2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.</b>		
X	a) essay exam(s)	X	d) written homework
X	b) term or other paper(s)	X	e) reading reports
X	c) laboratory report(s)	X	f) other (specify)

**Required assignments may include but are not limited to the following:**

- A six page term paper is due. Page seven must be the bibliography or citation page. The topic must be directly related to Microbiology. There must be a minimum of 5 sources with 25-30 pages of research. One source must be less than six months old in age. Citation formats are supplied and must be followed exactly. Each term paper is followed by a 5-10 minute oral presentation to the entire class. An outline and any clarifying data must be presented in a PowerPoint format.
- A lab report is due each week. The lab report section is to be handed in with the color plates one week from the date of the lab.
- Students receive 1-2 reading assignments per semester. They must answer the questions, turn in the completed questions and be ready to discuss the articles at an appointed date and time.

<b>B. Problem Solving</b>			
Computational or non-computational problem-solving demonstrations, including:			
X	a) exam(s)	X	d) laboratory reports
X	b) quizzes		e) field work
X	c) homework problems		f) other (specify):

**Required assignments may include but are not limited to the following:**

- the making of osmotic environments for bacteria
- the flow chart in the identification of a prokaryote
- the identification of pathogens versus non-pathogenic bacteria

<b>C. Skill demonstrations, including:</b>			
	a) class performance(s)		c) performance exams(s)
	b) field work		d) other (specify)

**Required assignments may include but are not limited to the following:**

<b>D. Objective examinations including:</b>			
X	a) multiple choice	X	d) completion
X	b) true/false		e) other (specify):
X	c) matching items		

**COURSE GRADE DETERMINATION:**

Description/Explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.

4 lecture Exams at 100 points each; 3 lab exams at 100 points each; One Term Paper at 100 points; Quizzes and Homework at 200 points;

**VII. EDUCATIONAL MATERIALS**

For degree applicable courses, the adopted texts, as listed in the college bookstore, or instructor-prepared materials have been certified to contain college-level materials.

Validation Language Level (check where applicable):	College-Level Criteria Met	
	YES	NO
Textbook	<u>  X  </u>	<u>      </u>
Reference materials	<u>  X  </u>	<u>      </u>
Instructor-prepared materials	<u>  X  </u>	<u>      </u>
Audio-visual materials	<u>  X  </u>	<u>      </u>

Indicate Method of evaluation:

Used readability formulae (grade level 10 or higher)	<u>      </u>
Text is used in a college-level course	<u>  X  </u>
Used grading provided by publisher	<u>      </u>
Other: (please explain; relate to Skills Levels)	<u>      </u>

<i>Computation Level</i> (Eligible for MATH 101 level or higher where applicable)	<u>  X  </u>	<u>      </u>
Content		
Breadth of ideas covered clearly meets college-level learning objectives of this course	<u>  X  </u>	<u>      </u>
Presentation of content and/or exercises/projects:		
Requires a variety of problem-solving strategies including inductive and deductive reasoning.	<u>  X  </u>	<u>      </u>
Requires independent thought and study	<u>  X  </u>	<u>      </u>
Applies transferring knowledge and skills appropriately and efficiently to new situations or problems.	<u>  X  </u>	<u>      </u>

List of Reading/Educational Materials

Recommended - Tortora *Microbiology*, ed. 10th Benjamin Cummings Pub. Co., 2010,  
 Recommended - Johnson & Case *Lab Experiments in Microbiology- Symbiosis*, ed. 7th Benjamin Cummings Pub. Co., 2007,  
Primary and Secondary Journals

Comments:

- X   This course requires special or additional library materials (list attached).  
 Primary and Secondary Journals
- X   This course requires special facilities:  
 Gas Availability Biohazard waste disposal Microbiological supplies

Attached Files:

**BASIC SKILLS ADVISORIES PAGE** The skills listed are those needed for eligibility for English 125, 126, and Math 101. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least three major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.

(eligibility for Math 101) (as outcomes for Math 250)  <u>  X  </u> Performing the four arithmetic operations on whole numbers, arithmetic fractions, and decimal fractions. <u>      </u> Making the conversions from arithmetic fractions to decimal fractions, from decimal fractions to percents, and then reversing the process. <u>  X  </u> Applying the concepts listed above to proportions, percents, simple interest, markup and	1. Conversion of pounds to grams/liter in media preparation.  2. Resolution of a microscope from mm to um.  3. Measuring the length and width of microorganisms using objective calibrations.
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<p>discount.  <input checked="" type="checkbox"/> Applying the operations of integers in solving simple equations.  <input checked="" type="checkbox"/> Converting between the metric and English measurement systems</p>	
<p>(eligibility for English 126)  (as outcomes for English 262)</p> <p><input checked="" type="checkbox"/> Using phonetic, structural, contextual, and dictionary skills to attack and understand words.  <input checked="" type="checkbox"/> Applying word analysis skills to reading in context.  <input checked="" type="checkbox"/> Using adequate basic functional vocabulary skills.  <input checked="" type="checkbox"/> Using textbook study skills and outlining skills.  <input checked="" type="checkbox"/> Using a full range of literal comprehension skills and basic analytical skills such as predicting, inferring, concluding, and evaluating.</p>	<ol style="list-style-type: none"> <li>1. Use of microbiological terms such as pathogenicity, etiology, and virulence.</li> <li>2. Use of suffixes such as ase for enzymes, cidal for death, and static for inhibition.</li> <li>3. Students must be able to analyze the growth factors for microorganisms.</li> </ol>
<p>(eligibility for English 125)  (as outcomes for English 252)</p> <p><input checked="" type="checkbox"/> Writing complete English sentences and avoiding errors most of the time.  <input checked="" type="checkbox"/> Using the conventions of English writing: capitalization, punctuation, spelling, etc.  <input checked="" type="checkbox"/> Using verbs correctly in present, past, future, and present perfect tenses, and using the correct forms of common irregular verbs.  <input type="checkbox"/> Expanding and developing basic sentence structure with appropriate modification.  <input type="checkbox"/> Combining sentences using coordination, subordination, and phrases.  <input checked="" type="checkbox"/> Expressing the writer's ideas in short personal papers utilizing the writing process in their development.</p>	<ol style="list-style-type: none"> <li>1. Students must be able to read a 3-4 page article and summarize the article in their own words.</li> <li>2. Students must be able to write a 6 page term paper on one microbiology topic and present it in a flowing, organized fashion.</li> <li>3. Students must be able to analyze and answer basic microbiology questions and respond in writing.</li> </ol>
<p><u>Check the appropriate spaces.</u>  <input checked="" type="checkbox"/> Eligibility for Math 101 is advisory for the target course.  <input checked="" type="checkbox"/> Eligibility for English 126 is advisory for the target course.  <input checked="" type="checkbox"/> Eligibility for English 125 is advisory for the target course.  <i>If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.</i></p>	

<b>CONTENT REVIEW</b>
<b>BIOL 1 PRINCIPLES OF BIOLOGY</b>
<b>BIOL 11B BIOLOGY FOR SCIENCE MAJORS II</b>
<b>BIOL 5 HUMAN BIOLOGY</b>

<b>REQUISITES</b>
<b>Subject Prerequisite -- BIOL 1 PRINCIPLES OF BIOLOGY</b>

- understand scientific method and be able to apply the process to any situation that needs evaluation and recommendations. For example: the pre-nursing students are learning how to approach each patient and the evaluative process.
- evaluate comparative anatomy and physiology in living organisms. This applies to the normal vs. abnormal anatomy and physiology as well as comparing totally different organisms.

- identify the basic structure, metabolism and ecology of a variety of microorganisms (viruses; bacteria; fungal, protozoan, and helminth parasites) which in turn, will allow them to better understand how these microbes function in their specific environments.
- learn how some microorganisms are beneficial to mankind while others cause a variety of human diseases.
- develop important critical thinking skills as they evaluate the results of laboratory experiments and demonstrations.
- learn to use the scientific method and be able to evaluate a variety of laboratory experiments (such as Identification of Unknowns, Biochemical Tests, Temperature Effects on Growth, Antibiotic Sensitivity).
- develop important manual dexterity skills associated with operation of technical laboratory equipment (microscope, autoclave, agar plates, sterile technique apparatus, Enterotubes).

#### Subject Prerequisite -- BIOL 5 HUMAN BIOLOGY

- understand the structure and function of the following systems: circulation, digestive, respiratory, urinary, skeletal, muscular, nervous, sensory, endocrine, reproduction, and genetics and evolution
- apply the principles of genetics to humans and understand the outcome of normal and abnormal DNA
- understand the process of science and society, microscopy, and the cell
- identify human body levels of organization and homeostatic mechanisms
- understand the chemical basis of life
- evaluate scientific literature and current biological achievements

- identify the basic structure, metabolism and ecology of a variety of microorganisms (viruses; bacteria; fungal, protozoan, and helminth parasites) which in turn, will allow them to better understand how these microbes function in their specific environments.
- learn how some microorganisms are beneficial to mankind while others cause a variety of human diseases.
- develop important critical thinking skills as they evaluate the results of laboratory experiments and demonstrations.
- learn to use the scientific method and be able to evaluate a variety of laboratory experiments (such as Identification of Unknowns, Biochemical Tests, Temperature Effects on Growth, Antibiotic Sensitivity).
- develop important manual dexterity skills associated with operation of technical laboratory equipment (microscope, autoclave, agar plates, sterile technique apparatus, Enterotubes).

#### Subject Prerequisite -- BIOL 11B BIOLOGY FOR SCIENCE MAJORS II

- use scientific methods in performing experiments and collecting data;
- evaluate comparative anatomy and physiology in living organisms;
- identify life from an evolutionary approach, from basic organic molecules to whole organ systems;
- compare and contrast functional systems of living organisms;
- evaluate scientific literature and current biological advances;
- distinguish how all body systems work together to maintain homeostasis;

- identify the basic structure, metabolism and ecology of a variety of microorganisms (viruses; bacteria; fungal, protozoan, and helminth parasites) which in turn, will allow them to better understand how these microbes function in their specific environments.
- learn how some microorganisms are beneficial to mankind while others cause a variety of human diseases.
- develop important critical thinking skills as they evaluate the results of laboratory experiments and demonstrations.
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#### **ESTABLISHING PREREQUISITES OR COREQUISITES**

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

1. \_\_\_\_ The prerequisite/corequisite is required by law or government regulations.  
Explain or cite regulation numbers:
2. \_\_\_\_ The health or safety of the students in this course requires the prerequisite.  
Justification: Indicate how this is so.
3.  X  The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.  
Justification: Indicate how this is so.  
College Chemistry provides a foundation in pipette usage, chemical pathways, and work in chemical reactions.
4. \_\_\_\_ The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.

Justification: Indicate how this is so.

5.  Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.

Justification: Cite the statistical evidence from the research.

80% of Biology 1 graduates with HS chemistry class dropped out of Biology 31.

6.  The prerequisite course is part of a sequence of courses within or across a discipline.

Biol 1 or Biol 5 or Biol 11B and Chemistry 3A or 1A are the pre requisites for Biology 31.

7.  Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:

CSU Fresno CSU Northridge San Jose University San Diego State University -all require chemistry and/or biology as a pre requisite to Biology 31.