

College of San Mateo
Official Course Outline

1. **COURSE ID:** BIOL 240 **TITLE:** General Microbiology
Units: 4.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; 48.0-54.0 Lab hours; 16.0-18.0 TBA hours; and 80.0-90.0 Homework hours
Method of Grading: Letter Grade Only
Prerequisite: A college level biology course with a lab AND a college level chemistry course with a lab. This includes BIOL 110, BIOL 210, BIOL 220, BIOL 230, BIOL 250, BIOL 260, BIOL 130 with BIOL 132 (lab), BIOL 225 (Canada), OR BIOL 215 (Skyline), AND CHEM 192, CHEM 210, or CHEM 410.
Recommended Preparation:
Eligibility for MATH 110 or MATH 111.
2. **COURSE DESIGNATION:**
Degree Credit
Transfer credit: CSU; UC
AA/AS Degree Requirements:
CSM - GENERAL EDUCATION REQUIREMENTS: E5a. Natural Science
CSU GE:
CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B2 - Life Science
CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B3 - Laboratory Activity
IGETC:
IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: B: Biological Science
IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: C: Science Laboratory
3. **COURSE DESCRIPTIONS:**
Catalog Description:
Introduction to the morphology, physiology, and genetics of microorganisms, with emphasis on bacteria and viruses. Includes environmental, applied microbiology, and the role of bacteria and viruses in health and disease. Laboratory work consists of isolation, cultivation, and identification of bacteria and techniques used to demonstrate microbial properties; including serological methods and bioinformatics. (Recommended for students majoring in life science, physical science, health science, and nursing). One or more field trips may be required. Minimum 16 hours by arrangement required per term.
4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
Upon successful completion of this course, a student will meet the following outcomes:
 1. Describe or demonstrate an understanding of Taxonomy and Phylogeny of microorganisms and their relationship to human health and the environment.
 2. Demonstrate an understanding of the cell structure, genetic and metabolic characteristics and ecology of the various groups of microbes.
 3. Demonstrate mastery of laboratory techniques appropriate to microbiology and ability to organize qualitative and quantitative data into a laboratory report.
 4. Describe how the scientific method relates to the study and understanding of microbiology historically and in modern day applications.
 5. Demonstrate a knowledge of industrial, biotechnological and clinical applications of microbiology.
5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
Upon successful completion of this course, a student will be able to:
 1. Describe or demonstrate an understanding of Taxonomy and Phylogeny of microorganisms and their relationship to human health and the environment.
 2. Demonstrate an understanding of the cell structure, genetic and metabolic characteristics and ecology of the various groups of microbes
 3. Demonstrate mastery of laboratory techniques appropriate to microbiology and ability to organize qualitative and quantitative data into a laboratory report.
 4. Describe how the scientific method relates to the study and understanding of microbiology historically and in modern day applications.
 5. Demonstrate a knowledge of industrial, biotechnological and clinical applications of microbiology.

6. COURSE CONTENT:

Lecture Content:

1. Introduction to microbiology; a historical perspective and foundational scientists and their technological and conceptual advances.
2. Basic chemistry of life and cell structure, biomacromolecules; carbohydrates, lipids, proteins, nucleic acids, ATP
3. Cell structure: a comparison of prokaryote with eukaryote cells. Detailed description of prokaryote cell structures, and their function. Endosymbiotic theory.
4. Classification and Systematics of microbes.
5. Requirements of microbial growth, patterns and quantification of growth and cultivation of microbes.
6. Enzyme function, cell metabolism, energy requirements and carbon sources.
7. Physical and chemical means of controlling microbial growth, sterilization, disinfection and antibiotics.
8. Microbial genetics:
 - A. The central dogma, DNA structure, replication, transcription, translation.
 - B. Horizontal and vertical gene transfer.
 - C. Mutations.
 - D. Viruses.
 - E. Metabolic regulation.
9. Biotechnology, recombinant DNA technology, DNA fingerprinting and Bioinformatics.
10. Host-microbiol relationship; beneficial and pathogenic.
11. Immune Response to infection. Innate and acquired immunity and immunization,
12. Infectious disease of various body systems, disease transmission, virulence and infectivity.
13. Epidemiology and public health

Lab Content:

1. Microscopy and staining
2. Aseptic technique
3. Sampling and culturing bacteria and isolation of bacteria to pure culture
4. Growth requirements, metabolic and biochemical assays
5. Identification of bacteria
6. Bioinformatics
7. Quantification of bacteria
8. Food safety, pasteurization
9. Growth control, antimicrobial and antibiotic testing
10. Immunoassays

TBA Hours Content:

Students must complete an average of 1 hour per week (8 hours by the mid-point of the semester and an additional 8 hours by the end of the semester) in the Microbiology Lab and the Integrated Science Center.

The following activities and content are covered during the TBA hours.

1. Theory and practice of microscopy and staining.
2. Culturing of bacteria.
3. Biochemical and metabolic and growth assays.
4. Computer work to identify bacteria.
5. Computer work to perform bioinformatics.

7. REPRESENTATIVE METHODS OF INSTRUCTION:

Typical methods of instruction may include:

- A. Lecture
- B. Lab
- C. Activity
- D. Critique
- E. Directed Study
- F. Discussion
- G. Experiments
- H. Individualized Instruction

I. Observation and Demonstration

J. Other (Specify): • A lecture format is used to introduce new concepts and information. Time is provided to encourage student participation and discussion in question and answer periods. • The theory, purpose and practice of lab experiments will be outlined by the instructor. Students will perform experiments individually, in pairs or as assigned groups with 4 to 5 members. • Experimental data that is collected is shared with the class for evaluation and analysis. • Where appropriate, selected topics will be complemented by videos • TBA will be lab focused consisting of microscopy and staining practice, collecting results from biochemical and metabolic assays, computer work using software to identify bacteria and NCBI an similar software to perform bioinformatics exercises. TBA will take place in the microbiology lab room, supervised by a microbiology instructor.

8. REPRESENTATIVE ASSIGNMENTS

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

- A. Written short essay on regular exams
- B. Lab reports summarizing lab experiments, organizing qualitative and quantitative data and results with references to published literature.
- C. Study guides for each exam are written as a group project.
- D. Maintaining a detailed lab notebook.

Reading Assignments:

- A. Textbook and laboratory manual reading assignments.
- B. Background material from legitimate sources for lab reports.

Other Outside Assignments:

- A. Reading, study, internet and library research.
- B. Analyzing and interpreting lab data and results.
- C. Organizing group presentations and reports.

To be Arranged Assignments:

Students must complete an average of 1 hour per week (8 hours by the mid-point of the semester and an additional 8 hours by the end of the semester) in the Microbiology Lab and the Integrated Science Center. The following faculty supervised activities and content are covered during the TBA hours.

1. Theory and practice of microscopy and staining.
2. Culturing of bacteria.
3. Biochemical and metabolic and growth assays.
4. Computer work to identify bacteria.
5. Computer work to perform bioinformatics.

9. REPRESENTATIVE METHODS OF EVALUATION

Representative methods of evaluation may include:

- A. Class Participation
- B. Exams/Tests
- C. Group Projects
- D. Homework
- E. Lab Activities
- F. Oral Presentation
- G. Papers
- H. Projects
- I. Quizzes
- J. Written examination
- K. •Exams covering chapters of the text. (Multiple choice, matching, short essay questions) •Online homework and quizzes •Lab reports •Several group projects that include participation, oral presentations and written reports.

10. REPRESENTATIVE TEXT(S):

Possible textbooks include:

- A. Parker, N., Schneegurt, M., Thi Tu, A., Lister, P. , Forster, B.M.. *Microbiology*, 2018 ed. OpenStax, 2018
- B. Anderson, D., Salm, S., Allen, D.. *Nester's Microbiology: A Human Perspective*, 8th ed. McGraw-Hill, 2015

Possible manuals include:

- A. Michael J. Leboffe and Burton E. Pierce. Microbiology Laboratory Theory and Application, brief, 2nd edition, Morton, 01-01-2016

Possible software includes:

- A. JALVIEW. University of Dundee, School of Life Sciences, 2019 ed.
Jalview is a free, open source program developed for the interactive editing, analysis and visualization of multiple sequence alignments. It can also work with sequence annotation, secondary structure information, phylogenetic trees and 3D molecular structures.
- B. Probablistic Identification of Bacteria. University of Southampton, 2011 ed.
The program has three major functions: 1. the identification of an unknown isolate 2. the selection of additional tests to distinguish between possible strains if identification is not achieved 3. the storage and retrieval of results
- C. ABIS Online. ABIS Online (tgw1916.net), 2019 ed.
Advanced Bacterial Identification Software is a laboratory tool for bacterial identification, based on morpho-biochemical characters, cultural characteristics, growth conditions, ecology and pathogenicity data. The program allows a great flexibility in choosing biochemical tests and is an alternative to commercial systems or code-books. The software is linked with a germs Encyclopedia, the Kauffman-White scheme for Salmonella serovars identification, Lancefield grouping for streptococci and an antibiogram interpreter.

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Curriculum Committee Approval Date: November 2020

Effective Term: Fall 2021

Course Originator: Christopher Smith