Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: Shauni Calhoun **Date:** 11/12/2020

Department	Subject	Course Number	Title
Biology	Biology BIOL	125	Microbiology

Units/Hours

Each lecture unit requires 1 hour per week of class time, and 2 hours per week of study outside of class.
Each laboratory unit requires 3 hours per week of class time.
Each activity unit requires 2 hours per week of class time and 1 hour per week of study outside of class.

Lecture Units	Lab Units	Total Units
2.50	1.50	4.00
Lecture Contact Hours	**Lab Contact Hours**	**Total Contact Hours**
40.00 - 45.00	72.00 - 81.00	112.00 - 126.00
Lecture Homework Hours	**Lab Homework Hours**	
80.00 - 90.00	0	

Stand Alone:

Program Applicable

AA/AS Degree General Ed Breadth Area(s):

A NATURAL AND PHYSICAL SCIENCES

General Education Justification:

The BIOL 125 course introduces students to the world of microorganisms. BIOL-125 is a natural and biological science course taken by students pursuing Health Science careers. It satisfies the General Education Learning Outcomes for Option A, Area A - Natural and Physical Sciences. It will serve as one of the science courses with a lab requirement. It incorporates the following general education learning outcomes GELO1: Students will examine complex relationships between microorganisms and the environment where they exist and their role in the processes that support life (biogeochemical cycle). GELO2: Students will apply the scientific process by formulating an hypothesis and designing experiments using appropriate microbiological methods to analyze and interpret results. GELO3: Students will analyze and evaluate scientific evidence to distinguish between microbes that cause disease and those that contribute to health. GELO4: Students will use mathematical reasoning and graphing skills to evaluate quantitative data and solve problems in microbiology. GELO5: Students will gain the ability to understand the relation between science and society and discuss ethical issues in microbiology relating to health, disease and the benefits of microorganisms. GELO6: Students will gain the ability to use appropriate microbiological methods and equipment (microscopes, thermocyclers (PCR), gel electrophoresis units, spectrophotometers, autoclaves, etc.) to study microorganisms practicing effective safety precautions.

Maximum Enrollment: 24

Maximum Enrollment Justification:

Course has safety or compliance factors which influence the enrollment cap â€“ check all that apply:

* Course has safety or health reasons that the class should have a non-standard enrollment cap.
* Course has specific standards outside of the college calling for a specific or capped class size.

Justification: According to the American Society for Microbiology (ASM) Laboratory Teaching Guideline; microbiology labs should be limited to no more than 24 students due the risks posed to the health and safety of individual when working with Biosafety Level 2 (BSL-2) microorganisms. Students require closer supervision that can not be achieved with a larger class size. Additionally having instructional aides (I.A.s) no longer present in the classroom makes it even more difficult for the instructor to be able to closely supervise anymore than 24 students at a time.

Grading Method: Letter Grade or P/NP

TOP code: 0403.00

Can be Taken 1 **time(s) for credit** (max 4)

- Visual or Performing Arts course that is required to meet major requirements for UC/CSU
- Intercollegiate athletics course
- Academic/vocational competition course

Catalog Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course). (**75 words** or less in gray box below).

This course covers general microbiology, including topics on morphology, metabolism, genetics, epidemiology, infectious diseases, immunity and control of microorganisms. Students will learn aseptic laboratory techniques and the importance of aseptic procedures in clinical settings.

Schedule Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course). (**25 words** or less in gray box below).

This course introduces students to microorganisms their effects on human health covering topics on morphology, metabolism, genetics, epidemiology, infectious diseases, immunity and control of microorganisms.

Need for the course:

Biology 125 is taken by students pursuing health care careers to complete the Microbiology requirement. This course is transferable to CSUs and UCs. It serves as an elective course (science course with a lab) for non-science majors. This course is part of the following awards: Associate Degree in Biology-AS, Environmental Studies: Water and Soil Technologies/Environmental Engineering Emphasis-AS, IDS-Liberal Arts: Mathematics & Science Emphasis-AA, IDS-AS

Associate in Science-Science, NURS/RN-LVN to RN Transition- Certificate, NURS/RN-LVN to RN Transition-AS, NURS/RN-LVN to RN [30 Unit Non-Degree Option]-Certificate, NURS/RN -Nursing-AS, and NUTR-A.S.-T. in Nutrition and Dietetics for Transfer-AS

Prerequisite(s):

Prerequisites go through a separate approval process. See Forms E1-E6 for details.
(For further clarification, contact the Prerequisite Subcommittee)

- ANAT 101 with a Grade of C or better. or
- BIOL 115 with a Grade of C or better. or
- BIOL 100 with a Grade of C or better. and
- CHEM 107 with a Grade of C or better. or
- CHEM 100 with a Grade of C or better. or
- CHEM 101 with a Grade of C or better.

Corequisite(s):

Corequisites go through a separate approval process. See Forms E1-E6 for details.

-none-

Recommend Preparation:

Recommended Preparation goes through a separate approval process. See Forms E1-E6 for details.

-none-

Other Enrollment Criteria:

-none-

Learning Objectives:

(please number each objective and express in behavioral terms)
Upon the completion of the course the student will be able to do the following:

Lecture:

1. Analyze and describe the history and development of microbiology and key microbiological theories.
2. Differentiate the principles of inorganic and organic chemistry and their relation to microbiological concepts.
3. Describe, compare, and contrast the anatomy, physiology and taxonomy of bacteria, fungi, protozoa, algae, helminths and viruses.
4. Analyze and describe the metabolic pathways in prokaryotic and eukaryotic microorganisms.
5. Compare and contrast the morphological, chemical and genetic differences between prokaryotic and eukaryotic cells.
6. Categorize and compare the life history, classification, epidemiology, virulence and disease process of a wide variety of microorganisms.
7. Evaluate and interpret the relationship between health and disease.
8. Contrast and describe non-specific and specific disease defense mechanisms.
9. Contrast and describe the physical, chemical and chemotherapeutic methods of disease control that include mode of action, contraindications, spectrum and resistance of microorganisms to a variety of antibiotics.
10. Explain and analyze the influence of microorganisms on water, food, and agriculture.

Lab:

1. Describe, demonstrate and assess sterile technique in the maintenance and manipulation of microorganisms.
2. Design, perform, and evaluate experimental investigations in microbiology through the application of the scientific method.
3. Scrutinize, investigate, and solve the identity of an assigned unknown bacterium by applying knowledge gained with regards to morphological, cultural, and physiological characteristics of bacteria.
4. Assemble a comprehensive scientific report on the "unknown" identification process, including the construction of tables and diagrams (dichotomous key flow charts) in order to present the results in a clear and concise manner.

5. Formulate meaningful conclusions and correlations from class data of various experiments including ubiquity, evaluation of disinfectants, antiseptics, alcohol as a hand sanitizer, germicidal UV, and effects of antibiotics on microbial growth.

Course Content:

(please number the outline of main topics and subtopics)

1. Development and history of microbiology
2. Microscopy
    1. Concepts and function of the microscope
    2. Types of microscopy
3. Prokaryotic vs. eukaryotic cells
    1. Composition and structure
4. Bacterial metabolism and growth
5. Microbial genetics and biotechnology
6. Anatomy and physiology of microorganisms
    1. Bacteria
    2. Protozoa
    3. Algae
    4. Fungi
    5. Helminth
    6. Viruses, viroids, and prions
7. Epidemiology and pathogenicity
    1. Transmission of disease
    2. Virulence factors and toxins
8. Immunology and resistance to disease
    1. Innate and adaptive immunity
    2. Serology and vaccination
    3. Immunological disorders
9. Control of microorganisms
    1. Chemical and physical agents
    2. Pharmacology
10. Environmental microbiology
    1. Water and food safety
11. Infection and disease
    1. Bacterial, Viral, Fungal, Protozoan and Helminthic diseases
        1. Disease of the Skin and Eyes
        2. Diseases of the Nervous System
        3. Diseases of the Cardiovascular and Lymphatic Systems
        4. Diseases of the Respiratory System
        5. Diseases of the Digestive System
        6. Diseases of the Urinary and Reproductive Systems
12. Identification of Microorganisms (including the writing of an Unknown Report)

A. Methodologies of Identification

a. Morphological
b. Biochemical
c. Serological
d. Genetics

Lab Content:

(please number the outline of main topics and subtopics)

1. Microscope use
2. Ubiquity

3. Colony characteristics
4. Lab techniques
    1. Aseptic transfer
    2. Pure Culture
    3. Streak plate
    4. Pipetting
    5. Serial Dilution
    6. Smear preparation
    7. Staining
5. Biochemical reactions
    1. Carbohydrate fermentation
    2. Oxidase
    3. Catalase
    4. Citrate
    5. Indole
    6. Amino Acid Decarboxylation
    7. Hydrogen sulfide production
    8. Urease
    9. Hemolysis
    10. Motility
    11. Nitrate reduction
    12. Gelatin, starch, and casein hydrolysis
    13. DNase
6. Antiseptics and disinfectants
7. Germicial Properties of Ultraviolet light
8. Antibiotic susceptibility
9. Hand hygiene
10. Unknown bacterium identification
    1. Individual student project
11. DNA/rRNA sequencing and genetic transformation
12. Overview of anatomy and taxonomy of fungi
13. Overview of anatomy and taxonomy of protozoa
14. Overview of anatomy and taxonomy of helminths
15. Staphylococci and Streptococci

Methods of Instruction:

Methods of instruction may include, but are not limited to the following:

- **Method:** Lecture
  Integration: Lecture presentation and classroom discussion about fundamental microbiological concepts, complimented with accessible videos and animations, will assist students in understanding, evaluating, and thinking critically about complex microbiological principles.
- **Method:** In-class Exercises
  Integration: Individual, small, and large group cooperative learning activities will involve students in critical thinking, diagramming, matching, and compare and contrast interactions and activities on a variety of topics include microscopy, cell structure, metabolism, and genetics.
- **Method:** Observation and Demonstration
  Integration: Both virtual and classroom demonstration of laboratory procedures will help students prepare for the hands on laboratory experiments. Observation of demonstrations of the procedures prior to performing the techniques themselves will help students to successfully master critical laboratory procedures such as aseptic technique, microscopy, and staining.
- **Method:** Lab Activities
  Integration: Practical, hands-on laboratory exercises designed to assist students in learning critical techniques, the ability to follow protocols, analysis of data, including collecting and organizing data in a systematic fashion,

assessing the validity of the data, and drawing appropriate conclusions based on the results.

- **Method:** Online Activity/Discussion
  Integration: The discussion board in the CMS will be utilized to promote interaction, communication, and the ability to evaluate and relate medical information found on the internet with the key concepts being covered in the class. Discussions will be informative and reflective and promote casual yet educational conversations.
- **Method:** Papers and Reports
  Integration: Reports of laboratory experiments will include a variety of formats and styles of questions, including basic definitions and concepts, to scientific analysis and evaluation. Students will be required to record data and results, including pictures of specimens viewed on the microscope, as well as test tubes and petri plates. Students will be asked to analyze and interpret their own data/results as well as interpret larger (the entire class's data) and derive correlations and conclusions.
- **Method:** Individual Projects
  Integration: The "unknown" project requires students to revisit previously learned techniques and concepts to gain a deeper understanding of how characteristics of a bacterium can lead to its identification. A scientific report will be submitted at the conclusion of the project. The report will demonstrate the students ability to individualy carry out the scientific method and report their results and conclusions in a clear and concise manner.
- **Method:** Homework
  Integration: Homework will include but is not limited to: worksheets, venn diagrams, coloring pages, taking Chapter quizzes on the CMS, watching videos that are integrated in the CMS and submitting video notes or video quizzes on the CMS. The homework assignments are meant to complement the lecture content and to help students to further evaluate and apply the concepts covered in lecture.

Methods of Evaluation:

A student's grade shall be determined by the instructor using multiple measures of performance related to the course objectives. Methods of evaluation may include but are not limited to the following:

- **Method:** Quizzes
  Integration: Periodic quizzes will be given using the CMS for a specific course objective. Each quiz will be evaluated for completeness and the questions will assess the student's ability to identify the most accurate answer and eliminate flawed answers. Rapid feedback from the instructor will allow students to gauge their learning progress and prepare for the exams.
- **Method:** Papers
  Integration: The unknown project and report will assess the student's ability to identify and evaluate the correct microbiological techniques introduced during lab to appraise various morphological, biochemical and physiological experiments. Students will be assessed on their ability to interpret the data in order to correctly identify the Genus and species of an assigned unknown bacteria. A scientific paper will be submitted via the course CMS in order to be submitted into a plagiarism detection program. The paper along with tables, figures, and diagrams will also be turned in as a hard copy in person. Students will be expected to follow the provided report guideline and rubric.
- **Method:** Homework
  Integration: Homework will be posted on the CMS. Homework will include but is not limited to: worksheets, venn diagrams, coloring pages, additional readings, and videos, from which a summary or quiz will follow. The homework assignments are meant to complement the lecture content and to help students to further evaluate and apply the concepts covered in lecture. Students will submit their homework either in person or on the CMS. Homework will be graded in a timely manner and students will be provided individual feedback from the instructor.
- **Method:** Exams/Tests
  Integration: Exams and/or online quizzes will test the understanding of the core concepts of microbiology described in the course content. All tested material will include a variety of formats, such as, multiple choice, true and false, fill-in, definition, short answer, and essay. Each exam will be evaluated for completeness and the questions will assess student's ability to identify the most accurate answer, synthesize multiple concepts to derive a new insight, describe a process accurately, justify a proposed explanation, and predict future outcomes by applying the scientific method. Exam feedback will be provided by the instructor (through the CMS or email) to correct misunderstanding and promote continued learning.

- **Method:** Laboratory Assignments
  Integration: Students will read lab content, watch videos and demonstrations, and perform lab experiments. This will be followed by a laboratory assignment in which students will answer questions, record data, post photos of procedures and results, analyze data, and draw conclusions. The laboratory assignments will be submitted on the CMS, they will be graded in a timely manner and feedback will be provided by the instructor.
- **Method:** Class Participation
  Integration: The discussion board in the CMS will be utilized to promote interaction, communication, and the ability to evaluate and relate medical information, provided by the instructor and found on the internet, with the key concepts being covered in the class. Discussions will be informative and reflective and promote casual yet educational conversations. The topics may include: analogies, mapping exercises of terms and processes, societal views, controversies, and ethics. The instructor monitors the discussions to assess student participation and understanding.

Examples of Assignments:

Students will be expected to understand and critique college level texts or the equivalent. Reading and writing, as well as out of class assignments are required. These assignments may include but are not limited to the following:

1. Given a medical case scenario including signs and symptoms, propose a presumptive diagnosis and steps to take for a definitive diagnosis, explaining the rationale for the selection.
2. Examine and correctly follow an experimental protocol to identify an assigned unknown bacterial organism to the species level using morphological, cultural, and physiological characteristics.
    1. Describe the project and discuss the rationale of the process of bacterial identification in a scientific report. This will require critical thinking, assessing and sorting data, assembling and presenting the information into a clear and concise format.
    2. Create a dichotomous key/flow chart to outline the identification of the unknown that effectively communicates the entire process and outcome.
    3. Discuss how your thought processes evolved over the course of the project.
3. Choose an epidemiological report found on the MMWR/CDC website, effectively communicate the findings of the report to fellow classmates and interact with other students via posing questions and having meaningful discussion of the epidemiological reports on the CMS discussion board.
4. Perform aseptic technique and self assess your technique.
    1. What do you think you did wrong/right?
    2. Discuss the possible impacts to human health if aseptic technique is not properly carried out in a clinical setting and how the concepts of aseptic technique can be applied to your daily life.
5. Apply the scientific method to experiments carried out in lab, be able to: formulate a clear, answerable question; develop a testable hypothesis; predict expected results; collect and organize data in a systematic fashion and present the data in scientific format.

Textbooks:

- Tortora,Funke & Case (2019). *Microbiology: An Introduction, 13th Edition* Pearson. ISBN: 9780134720388
- Foster, J.W., Aliabadi, Z., Slonczewski, J.L (2017). *Microbiology: The Human Experience, First edition* W.W. Norton & Company Inc.. ISBN: 978-0393906080

Other Resources:

- MSJC Department of Biological Sciences. Laboratory Manual for Biology 125 - Microbiology Volume IV 4th Edition. MSJC , 07-01-2019.

Minimum Qualification

- Biological Sciences (Masters Required)