Las Positas College
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Course Outline for BIO 7C

MICROBIOLOGY

Effective: Fall 2018

I. CATALOG DESCRIPTION:
BIO 7C — MICROBIOLOGY — 5.00 units

This course focuses on viruses, bacteria, fungi, protozoans, and helminths, with an emphasis on their relationship to humans. Cultivation, control, metabolism, body's defense against disease, microbial genetics, laboratory tests, and contemporary diseases are discussed. Methods used in the laboratory include standard bacteriological techniques (culturing, staining, biochemical testing, sensitivity testing etc.) as well as some molecular and immunological techniques, such as PCR and ELISA. Laboratory work also includes identification of unknowns, and/or independent research projects.

3.00 Units Lecture 2.00 Units Lab

Prerequisite
BIO 30 - Intro to College Biology
with a minimum grade of C

CHEM 30A - Intro and Applied Chemistry I
with a minimum grade of C
or

CHEM 1A - General College Chemistry I
with a minimum grade of C

Strongly Recommended
BIO 7A - Human Anatomy
with a minimum grade of C

ENG 1A - Critical Reading and Composition
with a minimum grade of C

Grading Methods:
Letter Grade

Discipline:
- Biological Sciences

	MIN
Lecture Hours:	54.00
Expected Outside of Class Hours:	108.00
Lab Hours:	108.00
Total Hours:	270.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. BIO30
1. Describe and apply the scientific method and how it is used by scientists to further scientific knowledge;
2. Cite the characteristics and levels of organization exhibited by all living organisms;
3. Know the use of light microscope and dissecting scope.
4. Describe how cells/specialized cells are structured and function;
5. Describe basic cell metabolism
6. Describe/contrast, mitosis, and meiosis,
7. Describe structure, transmission and expression of genes
8. Describe how the modern (binomial) system names and classifies organisms.

B. CHEM30A
1. Make unit conversions in the metric system using the prefixes mega, kilo, deci, centi, milli, and micro;
2. Write electron configurations for the first twenty elements in the periodic table using shell and subshell notation;
3. Draw Lewis structures for simple covalent formulas and determine molecular geometry and polarity;
4. Identify and describe effects of intermolecular forces;
5. Use standard nomenclature;
6. Identify properties of states of matter;
7. Write balanced equations for chemical reactions including those in aqueous solution and those involving elementary oxidation-reduction (not in acidic or alkaline solution);
8. Define concentration units of solutions and use these definitions in problem solving—molarity, osmolarity, and percent;
9. Describe properties of solutions, including osmotic pressure and processes such as osmosis and dialysis and their application to biological systems;
10. Use the pH scale to compare acidity;
11. Describe buffer solutions in terms of their composition and function, especially ones in biological systems;
12. Write balanced net and total ionic equations;
13. Perform laboratory experiments in an efficient, safe and purposeful manner;
14. Describe factors affecting the rates of reactions;
15. Describe types of nuclear radiation, isotopes and their half-life, nuclear reactions, units of radiation, and medical/industrial uses;
16. Collect and analyze scientific data;
17. Use an electronic balance and various pieces of volumetric glassware;
18. Record laboratory observations in a useful, detailed manner;
19. Maintain laboratory records in standard scientific style;

C. CHEM1A
1. Write balanced chemical equations including net ionic equations;
2. Write balanced chemical equations for oxidation-reduction reactions;
3. Use standard nomenclature and notation;
4. Draw Lewis dot structures for molecules and polyatomic ions;
5. Describe bonding in compounds and ions;
6. Describe the nature of solids, liquids, gases and phase changes;
7. Describe network covalent bonding;
8. Define concentrations of solutions in terms of molarity, molality, normality, percent composition, and ppm;
9. Solve solution stoichiometry problems;
10. Determine the extent of molecular reactions through the study of equilibrium;
11. Utilize library and Internet resources in Chemistry;
12. Collect and analyze scientific data, using statistical and graphical methods;
13. Use a visible spectrophotometer;
14. Acquire and analyze data with a computer and appropriate software.

Before entering this course, it is strongly recommended that the student should be able to:

A. BIO7A
1. identify and describe the anatomy of the brain and spinal cord

B. ENG1A

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. Describe critical discoveries and events in the history of Microbiology and discuss the significance of this work;
B. Compare and contrast prokaryotic and eukaryotic cellular structure and function;
C. Conduct procedures to isolate, cultivate and identify bacteria;
D. Apply aseptic technique and handle microorganisms in a safe manner;
E. Identify common protozoans, cestodes, and nematodes that parasitize humans, know the diseases they cause, and describe select life cycles;
F. Identify arthropod vectors of disease and discuss select major arthropod borne diseases;
G. Recognize and describe selected pathogenic viruses and fungi and discuss associated diseases;
H. Describe and perform selected techniques used in genetic engineering;
I. Explain how the human body defends itself against disease;
J. Describe the theory and interpretation of common serological and molecular clinical laboratory tests, then utilize selected tests;
K. Demonstrate proficiency using the compound light microscope;
L. Explain the use of disinfectants, antiseptics, sanitizers and the mode of action of selected examples;
M. Discuss various selected mechanisms of antibiotic and antiviral sensitivity and conduct and interpret antibiotic sensitivity testing;
N. Apply and interpret selected bacterial staining methods and recognize shapes, arrangements, and morphological structures of bacteria;
O. Utilize and interpret complex selective and differential media and various biochemical tests commonly used for bacterial identification;
P. Review, differentiate, and categorize various selected infectious diseases;

V. CONTENT:

A. Lecture
1. Fundamentals of Microbiology
    a. Introduction to microbiology, including history, naming and classification.
    b. Functional anatomy of prokaryotic and eukaryotic cells
    c. Microbial growth
    d. Control of microbial growth
    e. Microbial metabolism
    f. Bacterial genetics
    g. Biotechnology and recombinant DNA technology
2. Survey of microbial agents
    a. Identification and classification of prokaryotes
    b. Identification and classification of relevant eukaryotes, specifically protozoa, fungi, algae, and helminths
    c. Identification and classification of viruses
    d. Viruses and cancer
    e. prions
    f. The human microbiome
3. Microbe host interactions
    a. Epidemiology
    b. Pathogenicity
    c. Innate immunity
    d. Adaptive immunity
4. Practical applications of Immunity

a. Immunization technology
b. Diagnostic immunology

5. Contemporary Infectious Diseases
   a. Skin and eye infections
   b. Respiratory system infections
   c. Nervous system infections
   d. Cardiovascular and lymphatic system infections
   e. Digestive system infections
   f. Infections of the urinary and reproductive systems

B. Laboratory
1. Laboratory Fundamentals of Microbiology:
   a. Laboratory safety and procedures
   b. Use and care of microscope
   c. Observing microorganisms through a microscope
   d. Bacterial growth
2. Basic Microbiology Techniques
   a. Preparation of media
   b. Aseptic technique
   c. Staining techniques
   d. Streak plate method for isolation
   e. Testing for bacteria and fungi in the environment
3. Metabolic Activities for Characterization and Identification of Bacteria
   a. Selective and differential media
   b. Biochemical testing
   c. Anaerobic culture methods
4. Rapid Diagnostics and Applied Microbiology Techniques
   a. Rapid multi-test systems, such as Enterotube II
   b. PCR
   c. ELISA
5. Bacterial Genetics
   a. Transformation
6. Microbes and Humans
   a. Skin microbiota
   b. Throat cultures
   c. Oral microbiota
   d. Urine cultures
   e. Gastrointestinal tract cultures
7. Eukaryotic Microbes
   a. Observation of clinically relevant fungi, protozoa, and parasitic helminths
8. Investigative laboratory projects

VI. METHODS OF INSTRUCTION:

A. **Research** - Research Group Project focusing on investigation and analysis of a Bacteriology topic, including descriptive and/or quantitative experiments.
B. **Guest Lecturers** - invited guest lecturers discussing relevant applied microbiological and clinical topics
C. **Lecture** - Multimedia lecture presentations and discussion of major themes and concepts
D. **Audio-visual Activity** - Utilization of animations, TED talks, video clips, and other audio-visual aids as homework learning tools and in class discussion start points
E. Readings from the text and the laboratory manual
F. **Student Presentations** - Student-led presentations on current events , clinically relevant case studies, and research findings
G. **Field Trips** - Field trips to clinical diagnostic laboratories
H. **Written exercises and case studies** - Selected written assignments investigating current events and relevant case studies
I. **Lab** - Laboratory exercises, including observations, collection and analysis of data and completion of laboratory reports

VII. TYPICAL ASSIGNMENTS:

A. Reading and Discussion
1. Read about the functional anatomy of prokaryotic and eukaryotic cells in your textbook. Diagram each of the 4 possible flagellar arrangements discussed in lecture. Explain the medical importance of bacterial capsules and endospores.
2. Read the chapter on microbial diseases of the digestive system. Be prepared to compare and contrast food poisoning versus food-borne infections. Explain the implications of this distinction in how a patient would be managed clinically.

B. Collaborative learning
1. Work with your lab partner on “Throat Culture”. Use a sterile swab to obtain an inoculum from the throat of your partner and swab a blood agar plate following the specified procedure in the lab manual.
2. Form groups of three students to dramatize a chosen infectious disease that is of interest to you. One student is the patient, one student acts as the doctor and the third student plays the lab tech. In your “play”, the “patient” displays all the symptoms, the “doctor” has to be able to answer questions from other class mates, and the “lab tech” explains the lab tests done and shows pictures of relevant test results. The presentation should take a maximum of 10 minutes. It should be an effective review of a given infection in order to remind ourselves of important points before the final. Since this is a drama, try to dress, look, and act the part. Do not tell the rest of the class what disease you will be enacting – they have to guess!

C. Writing
1. Complete the laboratory report for the Throat Culture Exercise in your lab manual.
2. Relevance Writing: Locate a current event story relating to any topic of this course in a local newspaper or in one of the big national newspapers. (Use the library web site to access any US newspaper). Cite the newspaper in which it was found (with dates and authors). Write a paragraph outlining the article. Write a second paragraph describing how this topic relates to the course as discussed in class (or described in the textbook – if not yet discussed in class). This will reinforce the course content and help you on the exams. Minimum of 600 words per relevance writing.

D. Mastering Microbiology - Textbook Website
1. Prelecture Homework: Complete the prelect HW assignment for Chapter 4 online. Answer all the questions and view the assigned animations to be able to participate in the class room discussions of Chapter 4.
2. Complete all the Test Prep assignments for Exam 2 before midnight of the day before the exam.

VIII. EVALUATION:

A. **Methods**

1. Exams/Tests
2. Quizzes
3. Research Projects
4. Papers
5. Oral Presentation

6. Projects
7. Group Projects
8. Home Work
9. Lab Activities

B. **Frequency**

1. At least 2 midterms
2. At least 8 laboratory quizzes and/or exams
3. At least 2 bacterial unknown determinations, or 1 bacterial unknown determination plus 1 research project
4. At least 1 oral presentation
5. At least 1 written research paper or written report
6. 1 comprehensive final examination
7. Weekly homework of various forms

IX. TYPICAL TEXTS:

1. Tortora, Gerard, Berdell Funke, and Christine Case. *Microbiology, an Introduction.* 12 ed., Pearson, 2016.
2. Foster, John, Zarrintaj Aliabadi, and Joan Slonczewski. *Microbiology - The Human Experience.* 1st ed., W. W. Norton, 2018.
3. Johnson, T., & Case, C.. Laboratory Experiments in Microbiology. Pearson , 2015.
4. Mastering Microbiology for Tortora, Funke, Case. Pearson, (12th).

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Laboratory coat
B. Colored pencils
C. Disposable gloves
D. Packet of 50 microscope slides
E. Fine point black sharpie