# BUTTE COLLEGE
## COURSE OUTLINE

I. **CATALOG DESCRIPTION**

**BIOL 15 - Introduction to Microbiology** **5 Unit(s)**

**Prerequisite(s):** CHEM 110, or CHEM 1, or CHEM 51 and one year high school biology, or BIOL 1, or BIOL 2, or BIOL 20, or BIOL 21
**Recommended Prep:** Reading Level IV; English Level IV; Math Level IV
**Transfer Status:** CSU/UC
51 hours Lecture
102 hours Lab

This course includes the study of the structure and function of viruses, bacteria, fungi and protozoa, with emphasis on the predominant pathogenic members of those groups. Study of basic organic chemistry, genetics, metabolism, microbe-host interactions, the immune response and etiological factors involved in disease are also included. Methods of detection, identification, isolation, culture, enumeration, and control of microbes are provided. Consideration is also given to applied and environmental microbiology, as well as biotechnology techniques. Graded only.

II. **OBJECTIVES**

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

A. Describe the structures of viruses, bacteria, fungi and protozoa and the function of these structures.
B. Employ basic microbiological equipment and methods for the study, identification and quantification of microbes.
C. Describe the basic metabolic pathways of microbes (energetics) and how metabolism relates to both the establishment of microbial infection and to the biochemical tests used in microbial identification.
D. Explain the role of microbes in infectious disease, including the features of the microbes that contribute to the establishment of infection.
E. Identify key microbial pathogens, how they are transmitted and the major symptoms of the diseases they cause.
F. Explain how the human immune system functions to prevent and control infectious disease.
G. Explain the central dogma of molecular biology and how mutations can lead to changes in protein function.
H. Describe the modern biotechnological methods used to identify and or quantify microbes and microbial infections (polymerase chain reaction and enzyme-linked immunosorbent assay); explain the advantages and disadvantages of these methods.
I. Perform calculations to determine unit conversions, dilution factors, microbial population size and generation time.
J. Describe how microbes are controlled by use of chemical and physical means and through the use of antimicrobial compounds; explain the limitations of these methods.
K. Describe the importance of microbes in key ecological processes and their role in bioremediation.
L. Apply the scientific method to evaluate experiments accurately and communicate conclusions effectively.

III. **COURSE CONTENT**

A. **Unit Titles/Suggested Time Schedule**

| | Lecture |
|---|---|
| Topics | Hours |

| | | |
|---|---|---|
| 1. | Overview of Microbes; Microbial Taxonomy | 2.00 |
| 2. | Types of microscopes | 1.00 |
| 3. | Chemistry of Life, Microbial Nutritional Requirements | 6.00 |
| 4. | Features of eukaryotic microbes | 1.00 |
| 5. | Structure and function of the features of a bacterial cell | 6.00 |
| 6. | Basic microbial metabolic processes and how these relate to the establishment of infection and to biochemical tests used to identify microbes | 7.00 |
| 7. | DNA replication, microbial population growth and methods of detection and quantification of microbes. | 4.00 |
| 8. | Control of microbes by chemical and physical means. | 3.00 |
| 9. | Expression and regulation of the genetic code. Types of mutations and their effect on protein function. | 6.00 |
| 10. | Features and representative life cycles of viruses | 4.00 |
| 11. | Horizontal gene transfer | 2.00 |
| 12. | Innate and adaptive immune systems | 3.00 |
| 13. | Infection, disease and mechanisms of pathogenicity | 3.00 |
| 14. | Review of key microbial pathogens and the major symptoms of the diseases they cause | 3.00 |
| Total Hours | | 51.00 |

Lab

| Topics | | Hours |
|---|---|---|
| 1. | Introduction to the microbiology lab; lab safety | 2.00 |
| 2. | Microbiological lab techniques | 6.00 |
| 3. | Use of the microscope for viewing and measuring cells; ocular micrometer calibration | 6.00 |
| 4. | Initial characterization of bacteria: Colony descriptions, gram stain, acid fast stain, capsule stain, endospore stain, determination of motility, common morphologies and arrangements of bacteria | 10.00 |
| 5. | Effects and salt concentration and temperature on microbial growth | 3.00 |
| 6. | Microbiological media: making media, composition of media, selective and differential media | 6.00 |
| 7. | Role of microbes in bioremediation and the sustainability of life on earth using the nitrogen cycle as an example. | 4.00 |
| 8. | Biochemical tests used to identify Gram positive cocci | 4.00 |
| 9. | Biochemical tests used to identify Gram negative rods | 4.00 |
| 10. | Identification of an unknown bacterium, including preparation of an identification flow chart from previous lab work | 6.00 |
| 11. | Counting microbial populations using direct microscopy and plate counts | 5.00 |
| 12. | Bacterial population growth; graphing of data and calculation of generation time | 5.00 |
| 13. | Microbial role in wastewater treatment and water quality analysis; coliform and biochemical oxygen demand testing | 4.00 |
| 14. | Microbial requirement for presence or absence of oxygen for growth; mechanisms of protection against toxic oxygen byproducts | 4.00 |

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|---|---|---|
| 15. | The eukaryotic microbes; fungi and protozoa | 6.00 |
| 16. | Identification of an unknown bacterium using PCR and gel electrophoresis | 6.00 |
| 17. | Effects of ultraviolet light on microbial growth; DNA repair mechanisms | 4.00 |
| 18. | Cultivation of bacteriophage; virus plaque assay | 4.00 |
| 19. | Testing for antimicrobial resistance or sensitivity: mechanisms of action of commonly used antibiotics and resistance mechanisms in bacteria | 6.00 |
| 20. | Laboratory tests involving immunological components: leukocyte differential count, ELISA test (as part of an epidemiological activity), agglutination | 5.00 |
| 21. | Microbial Explorations: how microbes are used in cheese making and other microbial food products | 2.00 |
| | Total Hours | 102.00 |

## IV. **METHODS OF INSTRUCTION**

A. Lecture
B. Instructor Demonstrations
C. Collaborative Group Work
D. Class Activities
E. Laboratory Experiments
F. A minimum of two hours work outside class per course unit is expected for this course; more may be required for a high level of success.

## V. **METHODS OF EVALUATION**

A. Exams/Tests
B. Quizzes
C. Final Examination
D. Written Assignments
E. Practical Evaluations
F. Students will fulfill the writing requirement by writing 22 lab reports and pre-labs of from 50 to 400 words each, by writing a Case Study report, and by answering essay questions on exams.

## VI. **EXAMPLES OF ASSIGNMENTS**

A. Reading Assignments
   1. Read through the information in your text book and lab manual on 11 antibiotics and be prepared to answer questions on each antibiotics mechanism of activity.
   2. Read through the information provided on a biochemical test. Be prepared to present to the class the goal of the test and how it works including the differential and selective ingredients.

B. Writing Assignments
   1. Research a case study with a partner and identify the pathogen causing the described signs and symptoms. Prepare a 1-2 page report justifying your conclusion; include references and any medical terms mentioned in the case study or your report.
   2. Read Lab 1, Aseptic Technique and Other Lab Techniques, in the Introduction to Microbiology Lab Manual and prepare 0.5-1 page outline of the activities you will perform during Lab 1.

C. Out-of-Class Assignments
   1. Using the pathogens packet provided learn the following components of 48 different human pathogens; scientific name, disease(s) caused, symptoms of the disease, transmission and other special features and then be prepared to answer questions about

them during in class quizzes and a cumulative final.

2. Look at an active ingredient label for a disinfectant found in your home, workplace or drug store. Research the ingredient and determine its mechanism of action and be prepared to discuss what you have learned in lecture.

## VII. RECOMMENDED MATERIALS OF INSTRUCTION

Textbooks:

A. Tortora, G., Funke, B., Case, C. Microbiology: An Introduction. 11th Edition. Benjamin Cummings, 2012.

B. Matiasek, M. and Yarosevich, K. Introduction To Microbiology Lab Manual. 2014 Edition. Butte College Press, 2014.

Materials Other Than Textbooks:

A. Students must provide their own scientific calculator, lab coat, disposable gloves and goggles.

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