BIO 113
MICROBIOLOGY FOR THE HEALTH SCIENCES
4 Credit Hours

Prepared by:
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Ms. Shirley Davenport, Dean, Arts & Science Education
BIO113: MICROBIOLOGY FOR THE HEALTH SCIENCES

I. CATALOG DESCRIPTION

A. Course pre-requisites/co-requisites:
   High school Biology and Chemistry or equivalent
   BIO101 (Introduction to Biology) with a grade of “C” or better within the
   previous 5 years of registration date
   Reading proficiency

B. 4 semester credit hours

C. Microbiology for the Health Sciences explores microorganism associated with
   health and disease and stresses concepts associated with transmission, infection,
   control, and the immune system. Laboratory time is required. Students cannot
   apply both BIO113 and BIO215 toward graduation. (F, S, Su)

II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

<table>
<thead>
<tr>
<th>Expected Learning Outcomes</th>
<th>Assessment Measures</th>
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<tbody>
<tr>
<td>Explain how early historical events led to the formulation of the germ theory;</td>
<td>Classroom lecture and discussion, homework assignments, quizzes and exams</td>
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<tr>
<td>summarize the early history of microbiology; analyze the germ theory and summarize its</td>
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<td>development; relate the contributions of Leeuwenhoek and other famous microbiologists to</td>
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<td>modern microbiology.</td>
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<td>Describe the general characteristics, structural components, shapes, sizes of Microbes;</td>
<td>Classroom lecture and discussion, homework assignments, quizzes and exams</td>
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<td>distinguish between monerans and protists based on their differences</td>
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<td>Identify the energy sources used by chemoorganoheterotrophs; describe the location,</td>
<td>Classroom lecture and discussion, homework assignments, quizzes, exams, and</td>
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<td>components, reactants and products of the metabolic pathways of metabolism, such as</td>
<td>laboratory activities</td>
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<td>glycolysis, the pentose phosphate pathway, the tricarboxylic acid cycle and the electron</td>
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<td>transport chain; differentiate between aerobic respiration and fermentation; deduce the</td>
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<td>importance of the end products of fermentation to the study of microbes; identify and</td>
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<td>describe the sugar metabolism tests, protein tests and</td>
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<td>Task</td>
<td>Activity</td>
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<tr>
<td>Catalase and oxidase tests on microbes; perform the sugar metabolism tests, protein tests and catalase and oxidase tests on microbes</td>
<td>Classroom lecture and discussion, homework assignments, quizzes, exams, and laboratory activities</td>
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<td>Analyze growth curves; prepare microbiology aerobes and anaerobes for growth in culture; inoculate broths and solid media; cultivate bacteria, fungi, and viruses; demonstrate and explain methods for sterilization and disinfection; explain fine modes of action of antimicrobial agents; use U.V. light sterilization, disinfectants and antiseptics; discriminate between the methods used to determine microbial sensitivity to antibiotics; test antibiotics on microbes; explain antibiotic resistance and describe several mechanisms by which microbes acquire resistance to antibodies; compare specific antibiotics and explain their actions</td>
<td>Classroom lecture and discussion, homework assignments, quizzes, exams, and laboratory activities</td>
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<td>Relate the role of epidemiology to the prevention of the spreading of disease and describe the key terms used by epidemiologists; evaluate the methods used to control communicable diseases; connect the role of the Centers of Disease Control (CDC) and other public health organizations to controlling communicable diseases</td>
<td>Classroom lecture and discussion, homework assignments, quizzes, exams, and laboratory activities</td>
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<tr>
<td>Compare and contrast key characteristics of innate, adaptive, active and passive immunity; describe the characteristics of antigens and antibodies; demonstrate how antibodies are tested for in a laboratory; explain the methods used to titer antibodies; classify the roles of T and B Cells to the immune system; summarize the types of hypersensitivities; explain the basic characteristics of allergies; describe mechanisms that microbes use to avoid the host immune system</td>
<td>Classroom lecture and discussion, homework assignments, quizzes, exams, and laboratory activities</td>
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<tr>
<td>Distinguish between many of the classical diseases associated with different organ systems based on:</td>
<td>Classroom lecture and discussion, homework assignments, quizzes, and exams.</td>
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causative agent, signs and symptoms, pathogenesis, epidemiology, methods of prevention, laboratory diagnosis and treatment; discriminate between zoonotic diseases and identify common examples; be able to express an understanding of Human Immunodeficiency Virus (HIV), its mode of transmission and be able to help educate the common public through conversation

Deduce the importance of normal microbial flora to the various organ systems; differentiate between the various types of relationships microbes can have with its host

Properly use a compound microscope; perform microscopy techniques such as heat fixation and gram staining. observe and illustrate the various microbiology morphology

Properly perform aseptic technique, demonstrate basic isolation procedures and laboratory methods of diagnosis for various diseases

Differentiate between selective and differential media; perform experiments using selective media to isolate microbes from the body as well as other sources; perform experiments using differential and selective media to isolate microbes

Evaluate isolation tests to identify an unknown microbe from a mixed culture; analyze their tests; produce a report summarizing their discovery of the identity of the unknown microbe

III. COURSE OUTLINE

A. Beginnings of microbiology and the Germ Theory
   1. Germ Theory
   2. Scientists involved in disproving Germ Theory
   3. Importance of microorganisms to life
   4. Past, present, and future challenges of microbes and disease
   5. Size of the microbial world
B. Survey of the microbial world
   1. Bacteria, archaea, and eucarya
   2. Nonliving members of the microbial world
   3. Structure and chemistry of the cytoplasmic membrane
   4. Permeability of the cytoplasmic membrane
   5. Bacterial cell wall structure and function
   6. Morphology and arrangement
   7. Structure and function of flagella & pili
   8. Structure and function of capsules and slime layers
   9. Structure and function of chromosome and plasmids
  10. Gene transfer
  11. Structure and function of ribosomes
  12. Structure and function of storage granules and gas vesicles
  13. Endosporulation structure and function
  14. Structure and function of eukaryotic organelles

C. Microbial metabolism
   1. Chemical reactions and bonding
   2. Properties of water
   3. pH
   4. Structure and functions of proteins
   5. Structure and function of carbohydrates
   6. Structure and function of lipids
   7. Structure and function of nucleic acids
   8. Differentiate between catabolism and anabolism
   9. Enzymes, ATP, and electron carriers
  10. Glycolysis
  11. Pentose phosphate pathway
  12. Tricarboxylic acid cycle
  13. Electron transport chain
  14. Aerobic respiration
  15. Fermentation

D. Growth and controlling growth
   1. Viral replication
   2. Binary fission
   3. DNA replication
   4. Transcription
   5. Translation
   6. Bacterial genetics
   7. Mutagens
   8. Mutations outcomes
   9. Biofilms
  10. Growth curve
  11. Temperature, oxygen, pH, and water requirements
  12. Reactive oxygen species
13. Describe the various approaches to sterilization and disinfection
14. Describe how an appropriate antimicrobial procedure is chosen
15. Antibacterial drug targets
16. Kirby-Bauer disk diffusion test
17. Mechanisms of antimicrobial resistance
18. Slowing and decreasing the spread of antimicrobial resistance
19. Antiviral drug targets
20. Antifungal drug targets
21. Antiprotozoan, antihelmintic drugs

E. Epidemiology
1. Common epidemiological terminology
2. Common methods of disease transmission
3. Pathogen and host factors that influence disease
4. Epidemiological studies
5. Disease surveillance
6. Emerging infectious disease
7. Healthcare associated and nosocomial infections

F. The immune system
1. Antigens
2. Antibodies
3. Innate immune system
4. First line of defense
5. Cells of the immune system
6. Cytokines
7. Pattern recognition receptors
8. Complement system
9. Phagocytosis
10. Inflammatory response
11. Adaptive immune system
12. Lymphatic system
13. Antigens/antibody protective outcomes
14. B-lymphocytes
15. Humoral response
16. T-lymphocytes
17. Cell-mediated response
18. Primary and secondary responses
19. Active and passive immunity
20. Hypersensitivities
21. Autoimmune disease
22. Immunodeficiency

G. Infectious diseases
1. Causitive agent
2. Signs and symptoms
3. Pathogenesis
4. Epidemiology
5. Treatment and prevention
6. Laboratory diagnosis
7. Describe and distinguish zoonotic diseases
8. HIV

H. Normal microbiota
   1. Symbiotic relationships
   2. Protective role of normal microbiota
   3. Koch’s Postulates and Molecular Koch’s Postulates

I. Microscopy techniques
   1. Common microscopy terminology
   2. Basic knowledge of light and electron microscopes
   3. Properly use a compound microscope
   4. Stain techniques

J. Aseptic technique
   1. Properly preform Aseptic Technique
   2. Obtain a pure culture
   3. Streak plate

K. Selective and differential media
   1. Distinguish between selective and differential media
   2. Analyze and interpret results from the use of the media

L. Identification of an Unknown
   1. Apply techniques acquired throughout the semester
   2. Create a pure culture from a mixture
   3. Create a Gram stain
   4. Analyze metabolic tests
   5. Construct a report of discovery of the unknown

IV. METHOD(S) OF INSTRUCTION
A. Lecture
B. PowerPoint presentations
C. Textbook assignments
D. Class discussions
E. Laboratory exercises

F. Research paper

V. REQUIRED TEXTBOOK(S)


VI. REQUIRED MATERIALS

No materials required

VII. SUPPLEMENTAL REFERENCES

No supplemental references required

VIII. METHOD OF EVALUATION

A. Distribution of final grade

Students are evaluated by quizzes, five hourly exams, a comprehensive final exam, laboratory practicum.

B. Assignment of final letter grades

- 90-100% = A
- 80-89% = B
- 70-79% = C
- 60-69% = D
- Below 60% = F

C. Attendance policy

Student attendance is mandatory. There are no excused absences. If a student misses more than 15% of the total time (including lecture and laboratory) that the class meets in a semester, the student may be prohibited from attending the class by the instructor. In such cases, the student must officially withdraw from the course by the designated withdrawal date in order to reduce the possibility of receiving a grade of “F” for the course.

No make-up exams are given, however students are allowed to drop their lowest grade on one of the hourly tests. This means, if they are absent on a test day, the missed test is automatically dropped. Students arriving more than 10 minutes late will not be allowed to take the test and that test grade will be dropped. Any additional missed tests/late arrivals
will result in a grade of zero and the test grade will not be dropped. The final exam is mandatory and cannot be made up.

Students arriving late to lab will not be allowed to participate in the laboratory activity and will receive a grade of zero. Students that leave lab before the successful completion of the lab will also receive a grade of zero. Laboratory exercises cannot be made up.

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Library phone 636-481-3169)

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College Website, http://www.jeffco.edu/jeffco/index.php?option=com_weblinks&catid=26&Itemid=84)

XI. ATTENDANCE STATEMENT

Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.