Course: Microbiology / BIO 235

Credits: 4 hrs. Credits (3hours of lectures and 3hours of lab each week)

Text: Microbiology, Prescott, Willey / Sherwood / Woolverton, 9th edition, WCB Publishing Company.
Other required materials: Disposable gloves (none latex), full length lab coat long sleeves with cuffs (Landau – style number 3178) required along with a coat hanger that can be labeled .)

Description of the Course:

A) Catalogue Description: A comprehensive study of microorganisms. Topics covered will include the basic characteristics, morphology, physiology, growth, reproduction, and genetics of bacteria, as well as, a brief taxonomical survey of the following microbial life forms: Archaea, Eubacteria, (Cyanobacteria, Mycoplasms, Rickettsia, Chlamydia), Fungi, Algae, Protozoans, and Viruses. Emphasis will be on species that affect humans. *Laboratory activities will include various techniques of staining, culturing, and isolating bacteria. The morphology and metabolic processes of select microbial groups will be studied. Student will learn to apply various modern bio-techniques that are used for controlling the growth of microbes, and to identify unknowns.* Prerequisites: BIO 121 and CHE 111 or CHE 121 required.(BIO 122 **strongly recommended**) OR written permission of the instructor. All courses passed with a "C" grade or better. ***Pre*-test *covering basic biological and chemical concepts is also required.***

B) General Course Objectives:

1) To aid the student in developing an understanding of life processes of microorganisms.

2) To aid the student in developing an understanding of the effect, both good and bad, that microorganisms have on our lives daily.

3) To provide a useful body of knowledge for students studying *biology, environmental science, food science, nutrition, nursing, dental hygiene, & medical technology.(*All areas of Biology)

Class Attendance Policy:

Attendance of all class activities in lecture and laboratory is required. Absences are counted from the first meeting of class. More than four consecutive or more than six accumulative absences could result in a student receiving a "F" grade in this course. An explanation of the cause of all absences should be given to your instructor.

Academic and Classroom Misconduct:

The instructor has primary responsibility for control over classroom and/or laboratory behavior and maintenance of academic integrity, and can request the temporary removal or exclusion from the classroom or laboratory of any student engaged in conduct that violates the general rules and regulations of the institution. Or any student engaged in conduct deemed hazardous in the laboratory. Extended or permanent exclusion from lecture or laboratory activities or further disciplinary action can only be effected through appropriate procedures of the institution.
Plagiarism, cheating on quizzes or tests, or any form of academic dishonesty is strictly prohibited. Students quilty of academic dishonesty directly or indirectly will receive a zero for the exercise or quiz or test and may receive a "F" grade for the course in addition to other possible disciplinary sanctions which maybe imposed through the regular institutional procedures. Any student that believes that he or she has been erroneously accused may appeal the case through the appropriate institutional procedures if their grade was affected. (***We will work under an Honors Code) JEC***

Procedure for Dropping the Course: *** College's Withdrawal Policy***

Any student who finds it necessary to discontinue this course **MUST** complete a withdrawal form in the Registrar's Office at the time of the withdrawal. If you can not withdraw in person you may call the Registrar's Office and provide them with the appropriate information. Students may withdraw from the course any time during the first *14th weeks, ***without*** written authorization from the instructor or their academic advisor. (* Deadline will be announced.)
Once you withdraw from class you are no longer eligible to continue attending class and/or take any remaining quizzes or test. Students who do not withdraw, but stop attending will be assigned an "F" grade in this course. Verbal withdraws ***CANNOT*** be accepted.

Tests:

There will be nine scheduled quizzes (additional pop quizzes may also be given), all quizzes are given during the first ten minutes of class. (No make-ups for quizzes). Three unit test, two lab tests and a comprehensive final exam will also be given. Unit tests are scheduled in advance and the test scores will be posted by your student I.D. number. Students are allowed to review the test during office hours only in the presence of the instructor. ***Note taking will* not *be permitted***.

Grade Determination:

½ of the semester's average, ¼ of the lab grade, ¼ of the score on the comprehensive final exam will determine the final course grade.

EXAMPLE: (Semester's Average)	½	(90)	=	45
(Lab Grade)	¼	(92)	=	23
(Final Exam Score)	¼	(96)	=	24
				92

The best seven quiz scores will be added together plus the score for quiz **10** and divided by eight to determine the quiz average. The quiz average and the three unit tests scores will be added together and divided by four to determine the semester's average. The lab grade will be determined by averaging the two lab test scores plus points for lab journals or reports and/or lab techniques. The comprehensive final exam consist of two hundred questions x 0.5 point, total possible points 100.

Grade Scale: There will be NO grading on the normal distribution curve.

100.00	-	94.50	=	A
94.49	-	90.50	=	A-
90.49	-	87.50	=	B+
87.49	-	84.50	=	B
84.49	-	79.50	=	B-
79.49	-	77.50	=	C+
77.49	-	74.50	=	C
74.49	-	69.50	=	C-
69.49	-	63.50	=	D+
63.49	-	59.50	=	D
59.49	-	00.00	=	F

Exemption Policy:

The instructor will determine who is to be exempted from taking the final exam, not the student. Exemption is an earned ***privilege*** not an inherited right. Any student that is exempted from taking the final exam will be notified in writing. Students being considered for exemption MUST meet all of the following requirements: (No exceptions for any reason!)

1) Good classroom conduct.
2) Only 1 absence from lecture or laboratory (excused or non-excused).
3) No more than three tardies during course of the semester in lecture or laboratory.
4) All unit tests and lab tests must be taken when scheduled (no make-ups).
5) No unit test score lower than **88**. (The average of the best seven quizzes cannot be lower than **90**)
6) The minimum lab test score is **90**.
7) Must have an overall semester's average of **95** or higher. (***Without rounding* off**)
8) Must have a semester's lab test average of **95** or higher. (***Without rounding off - earned lab points will* NOT *be used in determining eligibility for exemption***).
9) Intangibles.

Make-ups:

Any assignment missed can be obtained from the instructor. ***Lab work no makeups***. *Quizzes, scheduled or pop, cannot be made up for any reason.* Unit tests can only be made up by special arrangement with the instructor. Makeup tests will be granted on an individual basis only following a conference with the instructor; where the reason(s) for missing the test must be determined mitigating circumstances beyond the control of the student such as, illness, death in the family, or change in condition of employment.
All make-up tests will be scheduled during the week of the final exams. If two unit test are missed during the semester and/or if the final exam is missed the student will receive a "F" grade if he/she is failing other parts of the course or an "I" if the student is passing all other parts of the course.

* ***Lab exercises or lab work that utilizes live bacteria cannot be made up for any reason.***

Revisions to the Syllabus:

Students are responsible for learning all of the objectives and all of the items in the course outline whether they are discussed in lecture and/or laboratory or not. The instructor reserves the right to revise the objectives, topical outline, or academic schedule contained in this syllabus without notice. However, if the revisions affect scheduled unit tests a 48-hour notice will be given for the new test date.

Cellular phones and beepers: Classroom and Labs – NO CELLPHONE ZONE – TURN THEM OFF

Cellular phones and beepers are only allowed in class or lab if they are turned off or in silent mode. Under no circumstance are phones to be answered in class. When there are extenuating circumstances that require that a student be available by phone or beeper, that student must speak to the instructor prior to class, so that together they can arrive at an agreement.

Course Objectives – BIO 235 Microbiology

1. The student will develop "critical thinking skills" and learn to develop sound scientific conclusions by the analysis of scientific data.

2. The student will demonstrate knowledge of the scientific method through examples.

3. The student will be able to understand the scope of microbiology as it relates to other fields of science.

4. The student will be able to list and explain the characteristics of life shared by all living organism form microbes to man.

5. The student will gain an understanding of the general characteristics of various microbial life forms especially bacteria.

6. The student will be able to demonstrate knowledge of the characteristics used in the classification of microorganisms.

7. The student will develop an understanding of microscopes, microscopy, and the microbial world.

8. The student will be able to explain in detail the differences between prokaryotic and eukaryotic cells.

9. The student will be able to identify the major morphological characteristic of bacteria cells.

10. The student will be able to name the various structures of a bacteria cell and describe their functions.

11. The student will be able to list and describe in detail the energy requirements, electron or hydrogen requirements, and carbon requirements for the growth and cultivation of bacteria.

12. The student will be able to describe in detail all of the nutrient requirements for the growth and cultivation of bacteria and discuss the different nutritional types of bacteria.

13. The student will be able to list and explain the physical conditions required for the growth and cultivation of bacteria.

14. The students will be able to understand and demonstrate the procedures for cultivating microorganisms and the problems associated with cultivation.

15. The student will be able to demonstrate knowledge of the various reproductive processes of bacterial cells, and explain in detail the phases of growth in bacterial cells.

16. The student will be able to list the different categories of culture media and describe the use of each type of media in the cultivation of bacteria.

17. The student will be able to describe and demonstrate several pure culture techniques.

18. The student will be able to give the principal properties of enzymes and summarize their chemical make-up.

19. The student will be able to describe how enzymes function and list factors that affect enzymatic activity.

20. The student will be able to name the major classes of enzymes and describe their action.

21. The student will be able name and explain the three major biochemical processes by which bacterial cells phosphorylated ADP to from ATP.

22. The student will demonstrate knowledge of the photosynthetic process including photophosphorylation, the Calvin-Benson cycle, and the chemiosmotic theory.

23. The student will be able to explain the differences in the photosynthetic process in algae, cyanobacteria, and bacteria.

24. The student will be able to demonstrate knowledge of chemical energy and the respiratory process in bacteria, including the Embden-Meyerhof, Pentose Phosphate, and the Entner-Doudoroff pathways of glucose catabolism, the Kreb's cycle and the electron transport system.

25. The student will be able to demonstrate knowledge of anaerobic metabolism in bacterial cells and describe various fermentation pathways utilized by different species of bacteria.

26. The student will develop an understanding of the biosynthesis of proteins in bacteria.

27. The student will be able to describe DNA and RNA and explain their role in bacterial genetics.

28. The student will be able to describe various form of modification in the genetic make-up of bacterial cells.

29. The student will be able to define mutation, list the various types of mutations and describe their affects on bacterial cells.

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30. The student will be able to demonstrate knowledge of the diverse taxonomy of bacteria.

31. The student will be able to explain the characteristics and the taxonomy of diverse groups of fungi, algae, protozoans, and viruses.

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32. The student will be able to define and/or explain in detail the terms of microbial control.

33. The student will be able to describe the processes involved in controlling the growth and activities of microorganisms by antimicrobial agents.

34. The student will be able to outline the mode of action and limitations and physical agents used in the control of microbes.

35. The student will be able to list the major classes of chemicals agents used to control microbes, give specific example of the class of chemicals, and describe the mode of action of the chemical agent, as well as, the limitations of their use.

36. The student will be able to differentiate between synthetic drugs and antibiotics as chemotherapeutic agents used to treat infections. And name the biological source of the antibiotic, the spectra of organisms that it affects and the mode of action of each antibiotic listed.

37. The student will be able to demonstrate knowledge of nosocomial infections and describe their sources.

38. The student will be able to list the most common nosocomial infections and the most frequently isolated organism(s) that causes that infection.

39. The student will be able explain the types of patients that have the greatest risk for developing nosocomial infections and why they are at such high risk.

40. The student will be able to describe infection control and prevention in the clinical environment.

41. The student will be able to demonstrate knowledge of the normal flora in various anatomical areas of the human body and describe host-microbe interactions.

42. The student will be able to discuss in detail Koch's postulates in relationship to diseases.

43. The student will be able to list the portals of entry of microbes into the human body and explain in detail how microbes breach the portals.

44. The student will be able to list and discuss the invasive methods of bacteria and other microbes.

45. The student will be able to explain how microbes produce diseases.

46. The student will be able to list and explain the stages of infection and illness.

47. The student will be able to list and describe in detail the methods of non-specific resistance to diseases and infections in humans. (Innate or inborn immune processes)

48. The student will be able to describe the major features of acquired or adaptive immunity.

49. The student will be able to explain in detail the role of T-lymphocytes and B-lymphocytes in acquired immunity.

50. The student will be able to list the major classes of immunoglobulins (antibodies) and describe their role in immunity.

51. The student will be able to list the different types of humoral antibodies and explain their function.

52. The student will be able to describe the major events that occur during the primary and secondary immune responses.

53. The student will be able to describe the different types of immunity i. e. naturally acquired passive immunity, naturally acquired active immunity, artificially acquired active immunity, artificially acquired passive immunity.

54. The student will be able to demonstrate knowledge of diseases caused by microorganisms (bacteria, fungi, viruses, and protozoans) by portal of entry, and how these infectious agents damage the body.

55. The student will be able to discuss how infectious diseases of the human body are treated and/or prevented.

56. The student will develop an understanding of the importance of soil, water, food, medical, and industrial microbiology.

BIO 235 – Microbiology Laboratory Outcomes (Objectives):

1. The student will be able to list and describe the proper use of all safety equipment and devices used in this microbiology lab, as well as, follow all safety precautions while working in the microbiology laboratory.

2. The student will be able to list and describe the use of various types of microscopes as they relates to the study of microbiology.

3. The student will be able to name all of the parts of the "Bright Field" microscope and describe the function of each part.

4. The student will be able to demonstrate the proper technique (microscopy skills) for using the microscope in the microbiology laboratory.

5. The student will demonstrate the ability to use the microscope as a vital instrument for gathering data by direct observation.

6. The student will be able to describe and identify various microbial life forms, by studying the unique morphological differences of those life forms by direct observation using the microscope.

7. The student will be able to demonstrate the ability to perform and correctly interpret the results of following laboratory procedures: Isolation Techniques; Transformation of Escherichia Coli; DNA Restriction Analysis; Microbial Metabolic Test; Microbial Sensitivity Test.

8. The student will be able to name the major classes of staining procedures, give examples, and describe the purpose of each procedure.

9. The student will demonstrate the ability to carry out various staining procedures and correctly interpret the results.

10. The student will be able to demonstrate the ability to use various learned laboratory skills and critical thinking skills to identify "Unknowns".

TOPICAL OUTLINE (LECTURE) BIO 235 MICROBIOLOGY

UNIT 1

I) Introduction
- A) Critical thinking and the scientific method
- B) Characteristics of life
- C) Prokaryotic and Eukaryotic cells
- D) Groups of microorganisms
  1. Monera (Procaryotae)
     - a) Archaea
     - b) Eubacteria
       1) Cyanobacteria (blue-green algae)
  2. Protistae
     - a) Algae
     - b) Protozoans
     - c) Slime molds
  3. Fungi
  4. Acellular (non-cellular) organisms (viruses)

II) Characteristics and Classification of Microorganisms
- A) Characteristics
  1. Morphological
  2. Chemical composition of the cell wall
  3. Cultural
  4. Metabolic
  5. Genetic
  6. Antigenic
  7. Ecological
  8. Pathological
- B) Classification
  1. Species, Genus, Family, Order, Class, Phylum, Kingdom
  2. Scientific nomenclature – Binomial system of nomenclature

III) Bacterial Morphology
- A) Shape
  1. Spherical (Round) - coccus, cocci
     - a) Arrangements
       1) Diplo-
       2) Strepto-
       3) Staphylo-
       4) Tetra-
       5) Sarcina
  2. Cylindrical (Rod-like) - bacillus, bacilli
     - a) Arrangements
       1) By growth characteristics – Diplo- / Strepto-
       2) By morphology – Palisade
  3. Spiral - spirillum, spirilla

B) Size
C) The Anatomy of Bacteria Cells
    1. Bacterial Integuments
        a) Capsules
        b) Cell wall
            1) Protoplasts
            2) Spheroplasts
    2. Cell membrane (protoplasmic or cytoplasmic membrane)
    3. Bacterial Appendages
        a) Flagella
            1) Monotrichous
            2) Amphitrichous
            3) Lophotrichous
            4) Peritrichous
            5) Periplasmic
        b) Pili – Fimbriae / Sex pili
    4. Bacteria cytoplasm
    5. Bacterial cellular organelles
        a) Mesosomes
        b) Ribosomes
        c) Inclusion bodies
        d) Vacoules
        e) Bacterial nucleus
        f) Endospores

IV) Bacterial Cultivation
A) Nutritional Requirements
    1. Energy requirement
        a) Phototrophs
        b) Chemotrophs
    2. Source of electrons or hydrogen
        a) Lithotrophs
        b) Organotrophs
    3. Carbon requirement
        a) Autotrophs
        b) Heterotrophs
    4. Nutritional types
        a) Photolithotrophic autotrophs (Photoautotrophs)
        b) Photoorganotrophic autotrophs
        c) Chemolithotrophic autotrophs (Chemoautotrophs)
        d) Chemoorganotrophic heterotrophs (Chemoheterotrophs) (Heterotrophs)
        e) Chemolithotrophic bacteria
        f) Mixotrophic bacteria
        g) Mutant forms
            1) prototrophs
            2) auxotrophs

5. Elements and Compounds
    a) Nitrogen
    b) Sulfur
    c) Phosphorus
    d) Sodium
    e) Calcium
    f) Iron
    g) Potassium
    h) Magnesium
    i) Trace elements
        1) Zinc, Copper, Cobalt, Manganese
    j) Vitamins
    k) Amino acids
    l) Purines and Pyrimidines
    m) Water

B) Bacteriological Media
1. Nutrient agar and broth
2. Enriched media
3. Selective media
4. Differential media
5. Assay media
6. Media for the enumeration of bacteria

C) Physical Requirements
1. Temperature
    a) Psychrophiles
    b) Mesophiles
    c) Thermophiles
        1) Eu-thermophiles
        2) Facultative thermophiles
        3) Steno- or extreme thermophiles
2. Gaseous requirement
    a) Aerobic
    b) Microaerophiles
    c) Anaerobic
        1) Non-stringent or Non-strict anaerobes (aero-tolerant)(oxygen tolerant)
        2) Facultative anaerobes
        3) Stringent anaerobes or Strict anaerobes
3. Ph requirement
    a) Acidophiles
    b) Neutrophiles
    c) Alkalophiles
4. Specific Requirements - i. e. Halophilic / Barophilic

D) Reproduction Methods
1. Asexual
    a) Fission
    b) Budding
    c) Sporulation
2. Sexual Conjugation

E) Phases of Growth
   1. **Quiescent** stage
   2. **Lag** phase & transitional period
   3. **Logarithmic** or **Exponential** phase (**Log** phase)
   4. **Stationary** phase
   5. **Logarithmic** phase of decline (Death phase)

F) Colony or Cultural Characteristics
   1. Abundance of growth
   2. Size of the colony
   3. Margin
   4. Elevation
   5. Pigmentation (Chromogenesis)
   6. Optical features
   7. Odor
   8. Surface texture
   9. Consistency

G) Pure Culture Techniques
   1. Streak-plating technique
   2. Serial-dilution technique
   3. Spread-plating technique
   4. Pour-plating technique
   5. Chemical technique
   6. Single-cell isolation technique

V) Bacterial Metabolism

A) Enzymes
   1. Chemical properties
   2. Characteristics and physical properties
   3. Enzymatic action
   4. Factors affecting enzymatic activity
   5. Classification of enzymes

B) Photosynthesis
   1. Oxygenic microbes
      a) Non-cyclic photophosphorylation
   2. Anoxygenic microbes
      a) Cyclic photophosphorylation
   3. The Calvin-Benson Cycle

C) Cellular Respiration
   1. Glycolysis
      a) Embden-Meyerhof pathway
      b) Pentose-Phosphate pathway
      c) Entner-Doudoroff pathway
   2. Kreb's Cycle (TCA) (Citric acid cycle)
   3. Cytochrome system – Electron transport chain (Oxidation-reduction reactions)

D) Anaerobic Metabolism
   1. Glycolysis
   2. Fermentation
      a) Homofermentative bacteria and the biochemical pathway
      b) Heterofermentative bacteria and various biochemical pathways

VI) Bacterial Genetics
- A) The Bacterial Chromosome
- B) Genotype
- C) Phenotype
- D) DNA and RNA
- E) Biosynthesis
  1. DNA synthesis
     - a) Mutations
       1) types
       2) rates
  2. Protein synthesis
     - a) Transcription
     - b) Translation
  3. The operon theory
- F) Genetic Modifications
  1. Transduction
  2. Transformation

UNIT II

I) Bacteriological Classification and Characteristics
- A) Taxonomy
- B) Characteristics
  1. Morphological
  2. Chemical composition of cell wall
  3. Cultural
     - a) Energy, electron, carbon requirements
     - b) Nutrient requirements
     - c) Physical requirements
  4. Metabolic
  5. Antigenic
  6. Genetic
     - a) Low G + C
     - b) High G + C
  7. Ecological
  8. Pathological
- C) Taxonomic Scheme
  1. Kingdom
  2. Phylum – Division – ending (phyta or a)
  3. Class – ending (etes or ae or i)
  4. Order – ending (ales)
  5. Suborder – ending (ineae)
  6. Tribe – ending (eae)
  7. Family - ending (aceae)
  8. Genus
  9. Species

Criteria used to divide bacteria into four major divisions described in *First Edition of Bergey's Manual of Systemic Bacteriology* are: 1) the presence or absence of cell walls and 2) the chemical composition of the cell walls. Bacteria have been assigned to the following four phyla.

1. ***Gracilicutes. Gram-negative bacteria with thin cell walls containing peptidoglycan.* (Includes cyanobacteria and non – oxygenic photosynthetic bacteria.**
2. ***Firmicutes. These bacteria are usually gram-positive with thick rigid cell walls containing peptidoglycan.* (Includes filamentous bacteria.)**
3. ***Tenericutes. Bacteria without cell walls.***
4. ***Mendosicutes. These bacteria maybe gram-positive or gram-negative and have non-petidoglycan-containing cells walls.* (Archaea are the only members of the phyla.)**

D) Major Groups of Bacteria
   1. Phototrophic Bacteria
      a) Non-oxygenic phototrophs
         1) Purple non-sulfur bacteria (Rhodospirillaceae)
         2) Purple sulfur bacteria (Chromatiaceae)
         3) Green sulfur bacteria (Chlorobiaceae)
   2. Gliding Bacteria
      a) Order Myxobacterales
      b) Order Cytophagales
   3. Sheathed Bacteria
   4. Budding and/or Appendaged Bacteria
      a) Caulobacteraceae & Hyphomicrobiaceae
   5. The Spirochetes
      a) Order Spirochaetales
         1) Spirochaetaceae
         2) Leptospiraceae
   6. Spiral and Curved Bacteria
      a) Order Spirillales
         1) Spirillaceae
   7. Gram-Negative Aerobic Rods and Cocci
      a) Order Pseudomonadales
         1) Pseudomonaceae
      b) Order Azotobacterales
         1) Azotobacteraceae
      c) Order Rhizobiales
         1) Rhizobiaceae
      d) Order Methylomonales
         1) Methylococcaceae
      e) Order Halobacteriales
         1) Halobacteriaceae
   8. Gram-Negative Facultative Anaerobic Rods
      a) Order Enterobacteriales
         1) Enterobacteriaceae
      b) Order Vibrionales
         1) Vibrionaceae
      c) Order Pasteurelliales
         1) Pasteurellaceae
      d) Other genera not assigned to any family

9. Gram-Negative Anaerobic Bacteria
    a) Bacteriodales
        1) Bacteriodaceae
10. Gram-Negative Cocci and Coccobacilli
    a) Order Neisseriales
        1) Neisseriaceae
11. Gram-Negative Anaerobic Cocci
    a) Order Veillonellales
        1) Veillonellaceae
12. Gram-Negative Chemolithotrophic Bacteria
    a) Order Nitrobacterales
        1) Nitrobacteraceae
    b) Bacteria that metabolize sulfur
    c) Order Siderocapsales
        1) Siderocapsaceae
12. Methane-Producing Bacteria
    a) Order Methanobacteriales
        1) Methanobacteriaceae
13. Gram-Positive Cocci
    a) Micrococcaceae
    b) Deinococcaceae
14. Gram-Positive Endospore Forming Rods and Cocci
    a) Order Bacillales
        1) Bacillaceae
15. Gram-Positive Asporogenous Rod-Shaped Bacteria
    a) Order Lactobacillales
        1) Lactobacillaceae
16. Other Bacteria Types
    a) Coryneforms
    b) Arthrobacter
    c) Nocardioforms
    d) Order Actinomycetales
        1) Actinomycetaceae
    e) Mycobacteriaceae
    f) Actinoplanaceae
    g) Streptomycetaceae
    h) Mycoplasms
17. Bacteria-Like Microbes
    a) Rickettsias
        1) General Characteristics
        2) Classification
    b) Chlamydia
        1) General Characteristics

II) Other Microbes
A) Eumycetozoa (Slime mold)
    1. General Characteristics
    2. Classification

a) Major groups
   1) Acrasiomycetes (cellular slime mold)
   2) Myxomycetes (acellular slime mold)

B) Eumycota (Fungi)
   1) General Characteristics
   2) Major Groups their Specific Characteristics and Representatives
      a) Chytridiomycota
      b) Glomeromycota
      c) Microsporidia
      d) Zygomycota (Zygomycetes)
      e) Ascomycota (Ascomycetes)
      f) Basidiomycota (Basidiomycetes)

C) Algae
   1. General Characteristics
   2. Classification and Specific Characteristics
      a) Oxygen Phototrophic Bacteria (Cyanobacteria or Blue-green algae (Cyanophyta)
      b) Chlorophyta (Green algae)
      c) Euglenophyta (Euglenoids)
      d) Xanthophyta (Yellow-green algae)
      e) Pyrrophyta (Dinoflagellates)
      f) Cryptophyta (Cryptomonads)
      g) Bacillariophyta (Diatoms)
      h) Chrysophyta (Golden-brown algae)
      i) Rhodophyta (Red algae)
      j) Phaeophyta (Brown algae)

D) Protozoans
   1. General Characteristics
   2. Classification and Specific Characteristics
      a) Subkingdom (Protozoa) (14 Phyla)
         1) Phylum Apicomplexa
            a. Sporozoa
         2) Phylum Sacromastigophora
            a. Subphylum Mastiogophora (Flagellata)
               1a. Zoomastigophora
               2a. Phycomastigophora
            b. Subphylum Sarcodina
         3) Phylum Ciliophora (Ciliates)
         4) Phylum Labyrinthomorpha
         5) Phylum Microspora
         6) Phylum Ascetospora
         7) Phylum Myxozoa

E) Viruses
   1. General Characteristics
   2. Structure and Composition
      a) Capsid

   b) Nucleic Acid Core
   c) Envelope
3. Characteristics for the classification of viruses
   a) Examples of DNA animal viruses
   b) Examples of RNA animal viruses
4. Methods of cultivation
5. Replication
6. Viroids & Prions

UNIT III

I) Control of Microorganisms
   A) The Importance of Controlling Microbial Growth and Activity
   B) Definition of Terms of Control
      1. Asepsis
      2. Antisepsis
      3. Antiseptic
      4. Disinfectant
      5. Sterilization
      6. Sanitizer
      7. Microbicides (Germicides)
         a) Bactericidal agent
         b) Fungicidal agent
         c) Algicidal agent
         d) Virucidal agent
         e) Sporicidal agent
      8. Microbistasis
         a) Bacteriostasis
         b) Fungistasis
      9. Preservative
      10. Chemotherapeutic – Antimicrobial agents
      11. Death
         a) The death rate of bacteria
         b) Environmental factors that causes the death of microorganisms
   C) Control of Microorganisms by Antimicrobial Agents
      1. Cell wall damage or inhibition of cell wall synthesis
      2. Cell membrane damage
      3. Alteration of cellular proteins and/or alteration of nucleic acids
      4. Inhibition of enzymatic activity
      5. Inhibition of nucleic acid synthesis
      6. Inhibition of protein synthesis
   D) Control by Physical Agents & Their mode of action (Antimicrobial properties)
      1. Temperature
      2. Desiccation
      3. Osmotic pressure
      4. Radiation
      5. Ultrasonic vibrations
      6. Electricity
      7. Surface tension
      8. Filtration

E) Control by Chemical Agents
   1. Major groups of chemical agents & Their mode of action (Antimicrobial properties)
      a) Phenols and phenolic compounds
      b) Alcohols
      c) Halogens
      d) Heavy metals and their compounds
      e) Acridine dyes
      f) Soaps & Detergents
      g) Ammonium compounds
      h) Aldehydes
      i) Gaseous agents
   2. Chemotherapeutic Agents
      a) Synthetic drugs
         1) Some common drugs
         2) The mode of action of the drugs (Antimicrobial properties)
      b) Antibiotics
         1) Some common antibiotics products
         2) Microbial derivation
         3) Primary spectrum
         4) Mode of action (Antimicrobial properties)

F) Control of Microorganisms in a Clinical Environment
   1. Nosocomial infections
      a) The most frequent types of infections
      b) The most frequently encountered organisms
      c) The most at risk procedures for causing nosocomial infections
      d) Persons at the greatest risk for developing nosocomial infections
   2. Methods of reducing or preventing the occurrence of nosocomial infections

II) Microorganisms and Disease
   A) Normal Flora (Microbiota)
   B) Transient Organisms
   C) Host-Microbe Interactions
      1. Epidemiology
         a) Epidemic
         b) Endemic
         c) Pandemic
         d) Sporadic
      2. Koch's Postulates and Diseases
      3. Infection, Infestation, and Parasitism
      4. Pathogenicity and Virulence
      5. Portals of Microbial Entry into the Human Body
         a) Respiratory System – Airborne
         b) Digestive System – Food and Water Borne
         c) Uro-gential System – Direct contact
         d) Integumentary System – Burns, Cuts, Abrasions, Wounds, Animal bites, Vectors
      6. Invasive Methods of Bacteria and Factors that Influence Virulence
         a) Specific proteins in the cell wall
         b) Capsules
         c) Pili

d) Enzymes
    1) Leukocidins
    2) Hemolysins
    3) Coagulases
    4) Kinases
    5) Hyaluronidase
    6) Collagenase
e) Toxins
    1) Exotoxins
        a) Toxoids
    2) Endotoxins

7. Invasive Methods of Other Microbes – Factors that Influence Virulence
    a) Viruses
    b) Fungi
    c) Protozoans
8. Pattern of Diseases (Periods of the acute illness)
    a) Incubation period
    b) Prodromal period
    c) Period of the acute illness
    d) Decline and recovery period
9. Natural Resistance to Diseases and Infections (Innate or non-specific resistance)
    a) Species resistance
    b) Mechanical barriers
    c) Enzymatic activity & Chemical action
    d) Interferons
    e) Inflammation
    f) Phagocytosis
    g) NK – cells
    h) Fever
10. Specific Immunity – Acquired or Adaptive Immunity
    a) T-lymphocyte system – Cellular mediated immunity
        1) T – Helper cells
        2) T – Cytotoxic cells
        3) T – Suppressor cells
    b) B-lymphocyte system – Antibody mediated or humoral immunity
        1) The major classes of Immunoglobulins (antibodies) and their role in immunity
            a. IgG
            b. IgM
            c. IgA
            d. IgD
            e. IgE
        2) Humoral antibodies (immunoglobulins) and their primary functions
            a. Antitoxins
            b. Agglutinins
            c. Precipitins
            d. Lysins
            e. Complement-fixating antibodies
            f. Opsonins
            g. Neutralizing antibodies

c) Interleukins
d) The primary immune response
e) Secondary immunity
f) Types of immunity
1) Naturally acquired passive immunity
2) Artificially acquired passive immunity
3) Naturally acquired active immunity
4) Artificially acquired active immunity

D) Diagnostic Application of Antigen-Antibody Reactions
1. Agglutination tests
2. Precipitin tests
3. Complement-fixation tests
4. Serological tests
5. Intracutaneous diagnostic tests

Diseases

E) Air-Borne Infections in Humans
1. Diptheria
2. Streptococcal infections
a) Pharyngitis
b) Scarlet fever
c) Rheumatic fever
3. Tuberculosis
4. Streptococcal Pneumonia (Other etiological agents of Pneumonia)
5. Mycoplasm Pneumonia
6. Menignitis
7. Pertussis or Whooping cough
8. Small Pox
9. Chicken Pox
10. Infectious mononucleosis
11. Measles (Rubeola)
12. German measles (Rubella)
13. Mumps
14. Influenza
15. Reye's Syndrome
16. Guillian-Barre Syndrome
17. Rhinitis (Common Cold)
18. Poliomyelitis
19. Psittacosis
20. Legionaire's disease
21. Pneumocystosis
22. Systemic Mycosis
a) Actinomycosis
b) Nocardiosis
c) Cryptococcosis
d) Moniliasis
e) Blastomycosis
f) Histoplasmosis
g) Coccidiomycosis
h) Sporotrichosis

F) Food and Water-Borne Human Infections
   1. Gastroenteritis
      a) Campylobacter
      b) Escherichia
      c) Samonellosis
   2. Typhoid fever
   3. Shigellosis – Bacillary dysentery
   4. Cholera
   5. Brucellosis
   6. Botulism (Bacterial Food Poisoning)
   7. Other forms of bacterial food poisoning
   8. Hepatitis
   9. Amebiasis
   10. Toxoplasmosis
   11. Infections of the Mouth

G) Sexually Transmitted Diseases (STD'S)
   1. Non-specific urethritis (Chlamydia)
   2. Gonorrhea
   3. Syphilis
   4. Genital Herpes
   5. A. I. D. S.
   6. Some lesser known STD'S

H) Diseases Acquired Through Wounds and Abrasions
   1. Erysipelas
   2. Impetigo contagiosum
   3. Puerperal fever
   4. Peritonitis
   5. Tetanus
   6. Gangrene

I) Direct Contact Diseases of the Skin
   1. Leprosy
   2. Dermatomycoses

J) Human Infections Acquired via Vectors
   1. Plague
   2. Tularemia
   3. Yellow fever
   4. Encephalitis
   5. Malaria
   6. Rickettsial diseases
   7. Leishmaniasis
   8. Trypanosomiasis
   9. Lyme's disease
   10. Dengue fever

K) Diseases caused by Prions

L) Infectious diseases of plants (Optional)

M) Infectious diseases of animals (Optional)

ACADEMIC SCHEDULE BIO 235 MICROBIOLOGY

LECTURE: 1:00pm – 2:25pm (MONDAY & WEDNESDAY)
LAB: 01:00pm – 04:00pm (Tuesday)
LAB: 01:00pm – 04:00pm (Thursday)

FALL 2014 ***James E. Copeland***

WEEK	– DATE	**********LESSON(S)**********
1	08/27	The Scientific Method and Critical Thinking/Characteristic of Life/ Procaryotic and Eucaryotic Cells - Required reading – Chapters 1, 3 & 4 ***Pre-Test (4:10pm -5:20pm) in A211***
2	***09/01***	***Labor day (NO CLASS)***
2	09/03	The Morphology of Bacterial – Required reading – Chapter 3
3	09/08	*Quiz 1* / The Anatomy of a Typical Bacteria Cell – Required reading – Chapter 3 Microbial Growth – Required reading – Chapters 6 & 7
3	09/10	Microbial Growth – Required reading – Chapters 6 & 7
4	09/15	*Quiz* 2 Microbial Growth – Required reading – Chapters 6 & 7
4	09/17	Microbial Growth cont'd / Microbial Metabolism–Required reading–Chapters 9,10,11
5	09/22	Microbial Metabolism – Required reading – Chapters - 9, 10, 11
5	09/24	*Quiz* 3 Microbial Metabolism cont'd / Microbial Genetics – Required reading Chapters 12,13,14,14,16
	09/24	***Last Day to retake Pre-test (4pm – 5pm)***
6	09/29	Microbial Genetics – Required reading – Chapters 12, 13, 14, 15, 16
6	10/01	******* UNIT TEST 1 ********
7	10/06	Taxonomy and the taxonomy of bacteria – Required reading – Chapters 17,18,19,20,21,22,26,27,28,29,30,40,41,42 and handouts
7	10/08	Taxonomy of Bacteria – Required reading – Chapters 17,18,19,20,21,22,26,27,28,29, 30,40,41,42, Handouts / (***Quiz 4*** **take home – Due 11am 10/13/2014)**
8	10/13	Taxonomy of Bacteria – Required reading – Chapters 17,18,19,20,21,22,26, 27,28,29,30,40,41,42 and Handouts
8	10/15	*Quiz5* Taxonomy of Bacteria – Required reading – Chapters 17,18,19,20,21,22, 26,27,28,29,30,40,41,42 & Handouts
9	10/20	The Characteristic and Taxonomy of Slime Mold & Fungi – Required reading – Chapter 24

9	10/22	*Quiz 6* / The Characteristics and Taxonomy of Algae and Protozoans – Required reading Chapters 23
10	10/27	The Characteristic and Classification of Viruses – Required reading – Chapters 5 & 25
10	10/29	**********************UNIT TEST 2 ****************************
11	11/03	Control of Microbial Growth – Required reading – Chapter 8
11	11/05	Control of Microbial Growth – Required reading – Chapters 7 & 34
12	11/10	*Quiz 7* / Control of Microbial Growth cont'd / Nosocomial infections Required reading - Pgs. 884-886 Chapter 36 & Handouts
12	11/12	Nosocomial infections cont'd / Host-Microbe Interactions – Required reading – Chapters 31, 36 and Handouts
13	11/17	Host-Microbe Interactions – Required reading – Chapters 31, 36 and Handouts
13	11/19	*Quiz 8* /Defense against Disease – Required reading – Chapters 32, 33, 35 & Handouts
14	11/24	Defense against Diseases–Required reading – Chapters 32, 33, 35 & Handouts
14	11/26	Air-Borne Diseases – Required reading – Chapters 37, 38, 39 and Handouts
15	12/01	Air-Borne Diseases – Required reading – Chapters 37, 38, 39, and Handouts
15	12/03	*Quiz9* / Food and Water-Borne Diseases – Required reading – Chapters 37, 38, 39 and Handouts
15	12/08	Food & Water-Borne Diseases cont'd Diseases from Wounds and Abrasions/ Skin Disorders/Vector Diseases Required reading - Chapters 37, 38, 39, and Handouts ***12/08/2014 Last day to withdraw.***
16	12/10	****************UNIT TEST 3********************
17	12/15	Review Unit Test 3 – Review prep for final exam
17	12/17	**FINAL EXAM 1:00pm – 3:00pm**

BIO 235 MICROBIOLOGY LAB SCHEDULE – ROOM A211

WEEK	DATE	********** LESSON(S) **********
1	08/26 - 28	***Lecture: 1pm – 2:00pm*** ***2:10pm M/W* - Laboratory Safety & Procedures** **Microscopes and Microscopy – Required reading – Chapter 2 in your text book**
2	09/02 - 04	Care and Use of the Microscope
3	09/09/11	Morphological Identification & Classification of Various Microbial Groups
4	09/16/18	Microscopic Observation and Identification of Microbes Cont'd.
5	09/23/25	**LAB:** Isolation Techniques #
6	09/30-10/02	Experiment in Bacterial Transformation # / Living Microbes
7	**10/07/09**	***********LAB PRACTICAL 1* **/ Video DNA Analysis / Practice Techniques**
8	10/14/16	Experiment in DNA Analysis / **LECTURE: Taxonomy**
9	10/21/23	Cultural Characteristics / Simple and Gram Staining Techniques
10	10/28/30	Gram Staining Technique
11	11/04/06	Gram Staining Technique
12	11/**11**/13	**LAB:** Microbial Metabolic Test# – ***Lecture from 2:40pm – 4:00pm***
13	11/18/20	Acid-fast, Capsule and Endospore Staining Techniques
14	***11/25***	***No lab scheduled***
14	***11/27***	***No lab scheduled it's Turkey DAY!!!!!!!***
15	12/02/04	**LAB**: Microbial Sensitivity Test @ (1:00pm – 2:35pm) ***LECTURE:*** STD's (2:45pm-4:00pm)
16	**12/09/11**	********** LAB PRACTICAL 2 ********** Written and Unknowns**

Requires students to return to lab in 24 hours to observe the results of the experiment.
@ Requires students to return to lab in 24 hours to observe the results of the experiment.