**1. COURSE TITLE:** Microbiology

**2.** **COURSE NUMBER:** 2300 **CATALOG PREFIX:** BIOL

**3. PREREQUISITE:** BIOL 1102 or BIOL 1320 or BIOL 2206 or BIOL 1520

**4. COURSE TIME/LOCATION:**

**5. CREDIT HOURS:** 4 **LECTURE HOURS:** 3

**LABORATORY HOURS:** 1 **LAB CONTACT HOURS:** 3

**6. FACULTY CONTACT INFORMATION:**

**Instructor:**

**Email:**

**Phone:**

**Office Hours:**

**7. COURSE DESCRIPTION:**

This course covers the morphology and physiology of microorganisms and selected human parasites. Topics covered include basic chemistry, cell structure and function, metabolism, genetics, biotechnology, growth and control of microbes, normal human microflora, mechanisms of disease production, transmission of infectious diseases, immune responses, and the action of specific pathogens in the production of human infectious disease. There is also a brief introduction to environmental microbiology and various career options in microbiology. This must be taken at the same time as the corequisite laboratory course in Microbiology. The Microbiology Lab course exposes students to biosafety and the practice of good aseptic technique in growing and identifying live bacteria.

**8. LEARNING OUTCOMES:**

At the completion of this course the student will be able to:

**Core Concept: Evolution**

1. Demonstrate an understanding that cells, organelles, and all major metabolic pathways, evolved from early prokaryotic cells. (ASM 1, Ch 1, Ch 3, Ch 5, Ch7, Ch 11).
   1. List six groups of microorganisms (Ch 1).
   2. Define endosymbiotic theory with respect to mitochondria and chloroplasts (ASM 1a, Ch 3, Ch 11).
   3. State at least two characteristics that all living cells share (e.g., membrane, DNA, and metabolism) (ASM 1b, Ch 3, Ch 5, Ch 7).
   4. Recognize the evidence that supports the theory that mitochondria evolved from bacteria (ASM 1c, Ch 3, Ch 5, Ch 11).
   5. Describe the evidence that supports the theory that chloroplasts evolved from cyanobacteria (ASM 1d, Ch 3, Ch 5, Ch 11).
   6. Explain why glycolysis, the pentose phosphate pathway, and the tricarboxylic (Krebs) cycle are so highly conserved in living cells (e.g., 12 essential precursors and energy) (ASM 1e, Ch 5).
2. Recognize that mutations and horizontal gene transfer, with the immense variety of microenvironments, have selected for a huge diversity of microorganisms (ASM 2, Ch 11, Ch17)
   1. List three mechanisms of horizontal gene transfer in bacteria (ASM 2a, Ch 7).
   2. State two processes by which mutations can occur (ASM 2b, Ch 7).
   3. Recognize that mutation and gene transfer events such as transformation, transduction, and conjugation help bacteria gain new virulence factors, including the ability to make toxins and acquire antimicrobial resistance (ASM 2c, MINAH 7a, Ch 7, Ch 10, Ch 14).
   4. Recognize an example of a pathogen that evolved naturally or artificially to become attenuated (E.g., vaccine strains, intracellular pathogens, etc.) (ASM 2d, Ch 17)
3. Recognize examples of human impacts on the environment influencing the evolution of microorganisms (e.g., emerging diseases and the selection of antimicrobial resistance. (ASM 3, ASM 31, MINAH 7, Ch 1, Ch 7, Ch 10, Ch 14, Ch 17, Ch 23, Ch 25, Ch 26, Ch 27)
   1. Define the term nosocomial infection (ASM 3a, Ch 14).
   2. Define the term emergent disease (ASM 3b, Ch 1, Ch 14).
   3. Distinguish between the terms endemic, epidemic, and pandemic (ASM 3c, Ch 14).
   4. Describe two human practices (in medicine and agriculture) that have led to the increase of antibiotic resistance (e.g., antibiotics and sub-therapeutic doses of antibiotics in feed, stopping antibiotic therapy too soon, repeated use of the same antibiotic) (ASM 3d, Ch 10, Ch 26).
   5. Describe two human practices that have led to the development of dead zones in bays or oceans (ASM 3ae Ch 27).
   6. Give an example of a disease that has emerged due to human activities, and state what those human activities were (e.g., AIDS, Ebola virus, bird flu, Lyme disease, etc.) (ASM 3f, Ch 23, Ch 25).
   7. Explain how public health policies (e.g., quarantine and vaccination) can alter epidemic/pandemic progression (ASM 3g, ASM 31, Ch 14, Ch 17).
   8. Explain how not completing a full treatment of antibiotics can lead to an increase in resistance in a bacterial population (ASM 3h, Ch 10).
   9. Gene transfer events such as transduction, transformation, and conjugation help bacteria gain new virulence factors including the ability to make toxins and acquire antimicrobial resistance (MINAH 7a, Ch 7, Ch 10, Ch 14).
4. Recognize that the traditional concept of species is not readily applicable to microbes due to asexual reproduction and the frequent occurrence of horizontal gene transfer (ASM 4, Ch 4).
   1. Explain why the traditional definitions of species using reproductive isolation do not apply to Bacteria and Archaea (ASM 4e, Ch 4).
   2. List the hierarchy of taxa from general to specific (Ch 4).
   3. Describe the general process of sexual reproduction, and how it relates to the definition of species in eukaryotic organisms (ASM 4a, Ch 12).
   4. Describe binary fission as a means of asexual reproduction and bacterial population growth (ASM 4b, Ch 6).
   5. Define binomial nomenclature and provide examples (Ch 4).
   6. List and describe the three domains of life proposed by Woese and Fox (ASM 5a, Ch 4).
   7. Explain what features of 16S rRNA make it useful to compare the evolutionary relationship between organisms (ASM 5c, Ch 4).
   8. Determine the two most related and two least related organisms from a short list of 16S rRNA sequences (ASM 5d, Ch 4).
   9. List six procedures taxonomists use to identify and classify microorganisms (MINAH 23, Ch 4).
   10. Recognize what a dichotomous key is and how it can be used to identify an organism (Ch 4).
5. Use phylogenetic trees to determine the evolutionary relatedness of organisms. (ASM 5, Ch 3, Ch 4, Ch 5, Ch 11)
   1. List the three Domains of the phylogenetic tree of life. State a unique characteristic of each Domain (ASM 5a, Ch 4, Ch 11).
   2. Explain what features of 16S rRNA make it useful to compare the evolutionary relationship between organisms (ASM 5c, Ch 3, Ch 4, Ch 5, Ch 11).
   3. Draw inferences about evolutionary relatedness of organisms based on phylogenetic trees (ASM 5e, Ch 11).

**Core Concept: Cell Structure and Function**

1. Identify and characterize the properties of water, salts, acids and bases, carbohydrates, lipids, proteins, and nucleic acids (Ch 2).
   1. Use the periodic table to determine the number of valence shell electrons and potential ion charge can form for select elements (Ch 2).
   2. Explain how valence shell electrons form chemical bonds (Ch 2).
   3. Compare and contrast ionic, polar covalent, nonpolar covalent, and hydrogen chemical bonds (Ch 2).
   4. Define organic compound (Ch 2).
   5. Compare and contrast endothermic and exothermic chemical reactions (Ch 2).
   6. Compare and contrast synthesis, decomposition, and exchange chemical reactions (Ch 2).
   7. List and recognize the five qualities of water that make it vital to life (Ch 2).
   8. Compare and contrast acids, bases, pH scale, and salts, and explain the role of buffers (Ch 2).
   9. Define functional group as it relates to organic chemistry (Ch 2).
   10. Recognize the chemical structure and properties of lipids (Ch 2).
   11. Recognize the chemical structure and properties of carbohydrates (Ch 2).
   12. Recognize the chemical structure and properties of proteins including the four levels of protein structure (Ch 2).
   13. Recognize the five general functions of proteins in organisms (Ch 2).
   14. Recognize the chemical structure and properties of nucleic acids (Ch 2).
   15. Compare and contrast the structure and functions of DNA and RNA (Ch 2).
   16. Compare and contrast the structures of AMP, ADP, and ATP (Ch 2).
2. The structure and function of microorganisms have been revealed by the use of microscopy (ASM 6, ASM 32, Ch 4).
3. Define microscopy, magnification, and resolution (Ch 4).
4. Explain the relevance of electromagnetic radiation to microscopy (Ch 4).
5. Explain how bright-field microscopy works and how staining specimens improves resolution (ASM 6d, ASM 32, Ch 3, Ch 4).
6. List different kinds of light microscopes (ASM 6h, Ch 4).
7. List the common bacterial cell morphologies and cell arrangements (ASM 6a, Ch 3).
8. Identify microbial structures from a given image (ASM 6b, Ch 3, Ch 4).
9. Describe how the cell structure of Gram-negative and Gram-positive cells leads to a given Gram stain result (ASM 6c, Ch 4).
10. Recognize the advantages and disadvantages of using bright-field, phase-contrast, dark-field, fluorescence, confocal scanning laser, transmission electron, and scanning electron microscopy for a given situation (ASM 6h, Ch 4).
11. Identify the mechanism of action and spectrum of action of antimicrobial agents based on unique structures of target microbes. (ASM 7, Ch 3, Ch 9, Ch 10, Ch 13, Ch 15, Ch 16, Ch 25).
12. List two structures that both Gram-negative and Gram-positive cells have in common, and provide the function of each (ASM 7a, Ch 3).
13. List two structures that are unique to Gram-negative and to Gram-positive cells, and provide the function of each (ASM 7b, Ch 3).
14. Distinguish between cell envelope structures (e.g., membranes and cell wall, etc.) in Gram-positive and Gram-negative bacteria (ASM 7c, Ch 3).
15. List and characterize physical and chemical methods to limit microbial growth in clinical settings (MINAH 15a, Ch 9).
16. Predict whether the mechanism of action for a given antibiotic would affect Gram-positive and/or Gram-negative cells (ASM 7d, Ch 3, Ch 10).
17. Describe how bacterial structures (e.g., peptidoglycan, lipopolysaccharides, flagella, etc.) stimulate a non-specific immune response (ASM 7f, Ch 3, Ch 15).
18. Explain how antigenic shift can result in resistance to antibiotics, viral infection, and evasion of the immune response (ASM 7g, Ch 10, Ch 13, Ch 15, Ch 16, Ch 25).
19. Identify specialized structures that often confer critical capabilities of members of the domains Bacteria and Archaea (ASM 8, Ch 3).
20. Compare and contrast the structure and function of flagella, pili, and fimbriae (ASM 8b, Ch 3).
21. Explain how specialized structures (e.g., pili/fimbriae, capsules, lipopolysaccharides, spores, or flagella) enable a microbe to survive in a given environment (ASM 8e, Ch 3).
22. List the features of endospores that allow them to survive extreme conditions over long periods of time (ASM 8c, Ch 3).
23. Compare and contrast bacterial fimbriae with hami (Ch 3).
24. Compare and contrast major cellular properties of prokaryotic and microscopic eukaryotes (E.g., fungi, protozoa, and algae) (ASM 9, ASM 6, ASM 8, MINAH 19, Ch 3, Ch 4).
25. Identify four major processes of living cells (Ch 3).
26. Compare and contrast prokaryotic and eukaryotic cells (Ch 3).
27. List the two primary metric units used to measure the diameter of microbes (MINAH 19b, Ch 4).
28. Describe glycocalyces of bacteria and archaea and compare and contrast capsules from slime layers in bacteria (Ch 3).
29. List the components of a bacterial flagellum and the four bacterial flagellar arrangements (ASM 8a, Ch 3).
30. List the common bacterial cell morphologies and cell arrangements (ASM 6a, Ch 3).
31. Compare and contrast the cell walls of Gram-positive and Gram-negative bacteria in terms of structure and Gram staining (ASM 6c, Ch 3).
32. Describe the fluid-mosaic model of cell membrane structure (Ch 3).
33. Compare and contrast the structure of cell membranes and cell walls in Bacteria and Archaea (ASM 8d, Ch 3).
34. Describe bacterial cytoplasm and its components including the nucleoid and inclusions (Ch 3).
35. Identify (model or diagram) major eukaryotic cell structures and explain their associated functions (ASM 9a, Ch 3).
36. Compare and contrast the passive and active transport processes by which materials cross a cytoplasmic membrane (Ch 3).
37. Define osmosis and distinguish isotonic, hypertonic, and hypotonic solutions (Ch 3).
38. Compare and contrast glycocalyces and cell walls of bacteria, archaea, and eukaryotes (Ch 3).
39. Compare and contrast the structure and function of prokaryotic and eukaryotic flagella (Ch 3).
40. Compare and contrast the ribosomes of prokaryotes and eukaryotes (Ch 3).
41. Recognize the three types of filaments in a eukaryotic cytoskeleton as well centrosomes and centrioles (Ch 3).
42. Recognize the structural and functional characteristics of eukaryotic organelles including the nucleus, endoplasmic reticulum , Golgi body, lysosome, peroxisome, vesicle, vacuole, mitochondrion, and chloroplast (Ch 3).
43. State two unique structures present in Eukaryotes, but not in Bacteria and Achaea (ASM 9b, Ch 3).
44. Explain why eukaryotic cells need/have organelles, while bacterial and archaeal cells generally do not (ASM 9c, Ch 3).
45. Compare and contrast transcription and/or translation in Eukaryotes vs. Bacteria or Archaea (ASM 9d).
46. Explain why it is difficult to develop antifungal drugs. Describe some of the successful cellular targets that have been identified (ASM 9e).
47. Compare and contrast the lytic and lysogenic replication cycles of viruses. (ASM 10, Ch 13)
48. Label the key parts of a virus (ASM 10a, Ch 13).
49. Arrange the steps of a viral infection by bacteriophage in correct order, specifically, either a temperate or lytic phage (ASM 10b, Ch 13).
50. Compare and contrast the differences between lysogenic and latent viral infections (ASM 10e, Ch 13).
51. Describe how a lysogenic phage can contribute to virulence, and give one example (ASM 10f, Ch 13).

**Core Concept: Metabolic Pathways**

1. List and describe the extensive and often unique metabolic pathways of Bacteria and Archaea (e.g., nitrogen fixation, methane production, and anoxygenic photosynthesis (ASM 11, MINAH 14, Ch 5, Ch6, Ch 27).
   1. Distinguish among metabolism, anabolism, and catabolism (Ch 5).
   2. List elementary statements about metabolism including: acquiring nutrients; enzyme regulation; catabolism to store energy as ATP and form 12 precursor metabolites; anabolism as biosynthesis, polymerization, and assembly; and cell division (Ch 5).
   3. Distinguish between reduction and oxidation during redox reactions (Ch 5).
   4. Recognize the types, components, activation energy, and major factors that influence enzymes (Ch 5).
   5. List the three stages of aerobic carbohydrate catabolism including initial substrates, final products, and net energy production (Ch 5).
   6. Compare and contrast the terms aerobic respiration, anaerobic respiration, and fermentation (ASM 11b, Ch 5).
   7. List the processes that are unique to lipid, protein, and nucleic acid catabolism (Ch 5).
   8. State the difference between oxygenic and anoxygenic photophosphorylation (ASM 11c, Ch 5).
   9. Recognize that chemiosmosis is where ion gradients are used to generate ATP (Ch 5).
   10. Compare and contrast the three types of ATP phosphorylation (ASM 11a, Ch 5).
   11. Describe the reactants and products as carbon fixation by the Calvin-Benson cycle (Ch 5).
   12. Recognize that gene expression involves polymerization of proteins and nucleic acids (Ch 5).
   13. Compare and contrast regulation of metabolic activity by control of gene expression versus control of metabolic expression (Ch 5).
   14. Recognize examples of biosynthesis in carbohydrates, lipids, amino acids, and nucleotides (Ch 5).
   15. Given an energy source and a carbon source, determine the metabolic lifestyle of an organism (e.g., chemoheterotroph, chemolithoautotroph, photoheterotroph, or photoautotroph) (ASM 11d, Ch 6).
   16. Recognize major processes that occur in the carbon, nitrogen, sulfur, and phosphorus cycles (Ch 27).
   17. Identify the microbes involved in the symbiotic relationship some N2-fixing bacteria and plants and what the microbe contributes and what the plant contributes (ASM 11h, Ch 27).
   18. Relate a pathogen’s metabolic features (e.g., aerobic versus anaerobic metabolism, or ability to break down certain nutrients) to where they can thrive and have potential for introduction into humans (MINAH 14a, Ch 6, Ch 14).
2. Recognize that the interactions of microorganisms among themselves and with the environment are determined by their metabolic abilities. (ASM 12, Ch 6, Ch 27).
   1. Provide two examples of how microbial metabolism alters the surrounding physical environment (ASM 12a, Ch 27).
   2. Define quorum sensing (ASM 12b, Ch 6).
   3. Give an example of and explain how microbial metabolism is important to a relevant societal issue (e.g., health and disease, bioremediation, agriculture, etc.) (ASM 12c, Ch 27).
   4. Give an example of how quorum sensing is advantageous to bacterial cells in a given environment (ASM 12d, Ch 6).
   5. Give an example where the waste product of one microorganism serves as an important substrate for another organism (e.g., ammonia-oxidizing bacteria or ammonia-oxidizing archaea and nitrite-oxidizing bacteria, hydrogen producers and methanogens, sulfide oxidizers and sulfate reducers, etc.) (ASM 12e, Ch 27).
3. Demonstrate an understanding that a microbe’s survival and growth in a given environment depends on its metabolic characteristics (ASM 13, MINAH 14, Ch 6).
   1. Describe how oxygen affects the growth of aerobes, obligate anaerobes, and facultative anaerobes (ASM 13f, Ch 6).
   2. List the forms of oxygen that can be fatal to organisms and means present in some organisms to protect themselves from forms of toxic oxygen (Ch 6).
   3. Define cardinal temperature, maximum temperature, and minimum temperature for an organism (ASM 13a, Ch 6).
   4. Define thermophilic, psychrophilic, psychrotolerant, mesophilic, halophilic, acidophilic, alkalophilic, etc., organisms (ASM 13b, Ch 6).
   5. Name the four phases of bacterial batch culture growth, and describe what the cells are doing during each phase (ASM 13c, Ch 6).
   6. Explain in general terms what a chemostat is and for what it is used (ASM 13g, Ch 6).
   7. Describe how very high (or low) temperatures, pH, or salt concentration inhibit growth (e.g., membrane stability, enzyme activity, proton motive force, etc.) (ASM 13e, Ch 6).
   8. Recognize that a pathogen’s metabolic features (e.g., aerobic versus anaerobic metabolism or ability to break down certain nutrients) is essential for recognizing where they can thrive and their potential for introduction into humans (ASM 14a, Ch 6).
4. Demonstrate an understanding that microbial growth is controlled using physical, chemical, mechanical, and biological means. (ASM 14, MINAH 15, MINAH 16, Ch 9, Ch 10, Ch 15, Ch 16, Ch 17)
   1. Define the following: antibacterial spectrum, bacteriostatic, bactericidal, antibiotic synergism, and antibiotic antagonism (ASM 14a, Ch 9, Ch 10).
   2. List several strategies (i.e., quarantine, vector control, patient education) to break the epidemiologic triangle and prevent disease transmission (MINAH 13).
   3. Recognize that an understanding of microbial control (sterilization and disinfection methods) is essential to understand how critical, semi-critical, and non-critical equipment should be managed as well as how to properly prepare patient body sites for medical procedures like injections and surgery (MINAH 15c, Ch 9)
   4. Compare sterilization with pasteurization in terms of outcomes (ASM 14b, Ch 9).
   5. Compare ionizing radiation with UV radiation in terms of how they kill cells (ASM 14c, Ch 9).
   6. Explain two strategies that are used in human food preparation to minimize microbial growth during storage (ASM 14h, Ch 6).
   7. List physical and chemical methods used to limit microbial growth (MINAH 15a).
   8. Given a particular organism, develop an isolation scheme using selective media (ASM 14f, Ch 6).
   9. List some antimicrobial compounds that combat bacteria, fungi, helminths, protozoans, and viruses (MINAH 16, Ch 10, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25).
   10. Recognize that structural and functional features of microbes allows us to develop new antimicrobial drugs and assess drug specificity mechanisms to limit adverse drug effects (MINAH 16a, Ch 10).
   11. Recognize that the type of antimicrobial drug used to treat a particular pathogen depends on patient and microbe features (MINAH 16b, Ch 10, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25).
   12. State the function of complement in the immune response (ASM 14d, Ch 15).
   13. Describe how the non-specific immune response works to inhibit microbial growth (e.g., fever, engulfment, inflammatory response) (ASM 14i, Ch 15).
   14. Compare and contrast the role of cytotoxic and helper T cells in the specific immune response (ASM 14j, Ch 16).
   15. Explain how a vaccine can be used to elicit a long-term protective immune response (ASM 14k, Ch 17).
   16. Recognize that immune suppressed or immune compromised individuals may not be able to rely on nonspecific and specific immune defenses as biological control against pathogens (MINAH 15b, Ch 16).

**Core Concept: Information Flow and Genetics**

1. Recognize that genetic variations can impact microbial functions (e.g., in biofilm formation, pathogenicity, and drug resistance) (ASM 15, MINAH 7).
   1. Define the following: point mutation, genetic insertion, genetic deletion, and frameshift mutation (ASM 15a, MINAH 7, Ch 7).
   2. Predict wither a given mutation would result in a change of function in the resulting protein (phenotypic change) (ASM 15c, Ch 7).
   3. For a given point mutation, genetic insertion, or genetic deletion, describe a situation that would result in a non-functioning protein and one that would not (ASM 15d, Ch 7).
   4. Describe how different types of radiation and chemical mutagens cause changes in a genome (Ch 7).
   5. Discuss the relative frequency of deleterious and useful mutations (Ch 7).
   6. Recognize that there are many types of DNA repair processes (Ch 7).
   7. Define genetic recombination and contrast vertical and horizontal gene transfer (Ch 7).
   8. Compare and contrast horizontal gene transfer in bacteria by transformation, transduction, and conjugation (Ch 7).
   9. Describe simple and complex transposons and the effects of transposition (Ch 7).
   10. Explain Griffith’s classic experiment on transformation of rough and smooth cells of *Streptococcus*. Describe the relationship between capsule genes and virulence (ASM 15c, Ch 7).
   11. Recognize that genetic recombination help bacteria gain new virulence factors, including the ability to produce toxins and acquire antimicrobial resistance (MINAH 7a, Ch 7).
2. Identify the processes involved in gene expression as well as distinguishing characteristics among Bacteria, Archaea, and Eukaryotes (ASM 16, Ch 7).
3. Explain how chromosome structure differs in Bacteria, Archaea, and Eukaryotes (e.g., histones and circular/linear chromosomes) (ASM 16c, Ch 7).
4. State two characteristics of the universal genetic code (ASM 16a, Ch 7).
5. State the average size of genes and genomes in a bacterium vs. a human (ASM 16b, Ch 7).
6. Describe the structure and functions of various types of plasmids (Ch 7).
7. Compare and contrast DNA replication in Bacteria, Archaea and Eukaryotes, keeping in mind this is anabolism and polymerization of DNA (ASM 16d, Ch 7).
8. Explain how the genotype of an organism determines its phenotype (Ch 7).
9. Describe the three steps of RNA transcription, keeping in mind this is anabolism and polymerization of RNA (Ch 7).
10. Compare and contrast transcription initiation and termination between Bacteria, Archaea, and Eukaryotes (ASM 16g, Ch 7).
11. Explain the role of mRNA processing in Eukaryotes (ASM 16f, Ch 7).
12. Describe the genetic code in general and identify the relationship between codons and amino acids (Ch 7).
13. Describe the synthesis (anabolism and polymerization) of polypeptides, identifying the roles of three types of RNA and ribosomes (Ch 7).
14. Compare and contrast translation initiation between Bacteria, Archaea, and Eukaryotes (ASM 16h, Ch 7).
15. Explain how the organization of genes in an operon affects transcription in Bacteria, compared to a single gene (ASM 16e, Ch 7).
16. Recognize external and internal molecular cues of signals that regulate gene expression. (ASM 17, Ch 7)
17. State the role of a transcriptional repressor (or activator) (ASM 17a, Ch 7).
18. Define the role of each of the following: promoter region, RNA polymerase, activator binding site, repressor binding site/operator, sigma factor (ASM 17b, Ch 7).
19. Describe how bacteria can regulate gene expression at the level of transcription and translation (ASM 17c, Ch 7).
20. Explain how gene regulation leads to adaptation (ASM 17d, Ch 7).
21. Give examples of how internal or external chemical signals can control gene expression (ASM 17ef, Ch 7).
22. Give examples of mechanisms commonly found to regulate the activity of transcription factors, including types of post-translation modification and the binding of small molecule effector /ligands (ASM 17g, Ch 7).
23. Recognize that the synthesis of viral genetic material and proteins is dependent on host cells and the type of virus. (ASM 18, Ch 8, Ch 13, Ch 24, Ch 25)
24. Given a type of virus, list the steps that take place in the replication of its genome (ASM 18b, Ch 13).
25. Compare and contrast the multiplication of animal viruses and bacteriophages (ASM 18c, Ch 13).
26. Compare and contrast the viral enzymes needed by RNA, DNA, and retroviruses (ASM 18d, Ch 13, Ch 8, Ch 24, Ch 25).
27. Compare and contrast the host enzymes needed by RNA, DNA, and retroviruses (ASM 18e, Ch 13, Ch 24, Ch 25).
28. Recognize that cell genomes can be manipulated to alter cell function including the production of pharmaceuticals (ASM 19, ASM 30, ASM 31, ASM 36, Ch 7, Ch 8).
29. Define biotechnology and recombinant DNA technology (Ch 8).
30. Describe the function of reverse transcriptase in synthesizing cDNA from RNA (Ch 8).
31. Recognize how synthetic nucleic acids are synthesized and used (Ch 8).
32. Recognize what restriction enzymes do and how they can be used (Ch 8).
33. Recognize the common features of vectors used for genetic manipulation (ASM 19a, Ch 8).
34. Recognize the natural protective function of CRISPR against bacteriophages and its use in genetic engineering and potential treatment of human genetic diseases (Ch 8).
35. Recognize the significance of gene libraries (Ch 8).
36. Describe the purpose and application of the polymerase chain reaction (PCR) (ASM 36, Ch 8).
37. Recognize the use of DNA probes to identify recombinant cells (Ch 8).
38. Describe the process and use of electrophoresis to separate large molecules like DNA and proteins (ASM 36, Ch 8).
39. Recognize how DNA microarrays are manufactured and used (Ch 8).
40. Recognize four techniques for introducing DNA into cells (Ch 8).
41. Define gene mapping and recognize its uses (Ch 8).
42. Define genomics and recognize the differences between Sanger and next-generation sequencing (Ch 8).
43. Discuss how horizontal gene exchange contributes to the evolution of a genome and a species (ASM 19d, Ch 7).
44. Explain how a transposon can be used to create a mutant strain (ASM 19e, Ch 7).
45. List one example in medicine or in agriculture when bacteria acquired new genes that resulted in an altered cell function (ASM 19b, Ch 8).
46. Discuss two societal benefits achieved through the genetic manipulation of microbes (ASM 19g, ASM 30, ASM 31, Ch 8).

**Core Concept: Microbial Systems**

1. Recognize that microorganisms are ubiquitous and live in diverse and dynamic ecosystems, including the human body. (ASM 20, MINAH 2, Ch 6, Ch 11, Ch 12, Ch 13, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25, Ch 26, Ch 27).
   1. List two keystone bacterial guilds in these environments: oligotrophic ocean, marshland soil, and agricultural fields (ASM 20a, Ch 27).
   2. Describe an extreme environment where microbes can survive under conditions that humans cannot (ASM 20b, Ch 11, Ch 27).
   3. Explain what adaptations have occurred in psychrophiles / thermophiles / halophiles, etc., that permit them to exist in their optimal environmental growth conditions (ASM 20c, Ch 6, Ch 11, Ch 27).
   4. List the main characteristics of microbes that might be present in a given ecosystem, e.g., the animal gastrointestinal tract, the anaerobic mud layer at the pond bottom, etc. (ASM 20d, Ch 6, Ch 11, Ch 14, Ch 27).
   5. Relate different taxonomic groups to the potential for infection and infection management planning (MINAH 2a, Ch 11, Ch 12, Ch 13, Ch 19, Ch 20, Ch 21, Ch 22, Ch23, Ch 24, Ch 25, Ch 26).
   6. Recognize what microorganisms colonize different parts of the human body and relate to diagnosing infectious diseases and infection control (MINAH 2b, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch23, Ch 24, Ch 25).
2. Recognize that most bacteria in nature live in biofilm communities that operate in specific ways. (ASM 21, MINAH 3, Ch 6, Ch 10, Ch 11, Ch 14, Ch 19, Ch 20, Ch 27).
   1. Give an example of a beneficial and a detrimental biofilm (ASM 21a, Ch 3, Ch 4, Ch 6, Ch 10, Ch 11, Ch 14, Ch 19, Ch 20, Ch 27).
   2. List the stages of biofilm formation and maturation (ASM 21b, Ch 6).
   3. Give an example of how quorum sensing is advantageous to bacterial cells in a given environment (ASM 12d, Ch 6).
   4. Compare and contrast cell structure and function in a biofilm with pelagic cells (ASM 21c, Ch 6).
   5. Explain how and why biofilm development may differ in different environments (ASM 21d, Ch 4, Ch 6).
   6. Predict conditions that would favor biofilm formation and where they might be found (ASM 21e, Ch 6).
   7. Identify the stages of biofilm development that are more susceptible to destruction (ASM 21f, Ch 6).
   8. Explain the role of biofilms in chronic diseases/infections (ASM 21i, Ch 6).
   9. Recognize that biofilms present challenges to healthcare by providing a continuously available pathogen source for renewed infections and conferring resistance to antimicrobial agents (ASM 21, MINAH 3a, Ch 6).
   10. Recognize that biofilms form on implanted medical devices introducing challenges to infection control (ASM 21, MINAH 3b, Ch 6).
3. Identify examples where microorganisms and their environment interact and modify each other (ASM 22, Ch 26, Ch 27).
   1. Recognize the terms used to describe ecological relationships among microorganisms in the environment including: population, guild, microbiome, community, microhabitat, ecosystem, and biosphere (Ch 27).
   2. Explain the influences of competition, antagonism, and cooperation, on microbial survival (Ch 27).
   3. Recognize processes that occur in the carbon cycle (Ch 27).
   4. Give an example where the waste product of one microorganism serves as an important substrate for another organism (e.g., ammonia-oxidizing bacteria or ammonia-oxidizing archaea and nitrite-oxidizing bacteria, hydrogen producers and methanogens, sulfide oxidizers and sulfate reducers, etc.) (ASM 12e, Ch 27).
   5. Explain why the presence of nitrogen-fixing bacteria is often required to support other growth in a diverse ecosystem (ASM 22g, Ch 27).
   6. List two factors that limit growth in a batch culture (ASM 22a, Ch 6).
   7. Define the term eutrophication in aquatic ecosystems (ASM 22b, Ch 27).
   8. Identify the criteria used to assess microorganisms for potential used as biological weapons or agents of bioterrorism (Ch 27).
   9. Describe how microbial metabolism can be manipulated for food production (Ch 26).
   10. Recognize causes of food spoilage and methods for preventing food spoilage (Ch 26).
   11. List some of the various commercial products produced by microorganisms (Ch 26).
   12. Compare and contrast methods for treating drinking water and wastewater (Ch 26).
   13. Describe how fermentative bacteria in sourdough (or other foods) change their environment, and how that affects the initial community (ASM 22f, Ch 26).
   14. Recognize examples of host-parasite coevolution (ASM 22e, Ch 11).
   15. Explain how the presence of a microorganism elicits a cellular or humoral specific immune response (ASM 22d, Ch 16).
4. Compare and contrast the interaction of microbes with human and non-human hosts in beneficial, neutral, or detrimental ways. (ASM 23, MINAH 1, MINAH 4, Ch 6, Ch 14, Ch 15, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25)
   1. State two ways that the normal microbiota (or probiotics) are beneficial to a human host (ASM 23a, Ch 6, Ch 14).
   2. Name two sites on the human body colonized by the normal microbiota, and give an example of the type of organisms found at those sites (ASM 23b, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23).
   3. Describe at least two innate physical defenses in the human body that are used to fend off an infection (ASM 23c, Ch 15).
   4. Given a particular pathogen (or symbiont), describe how it creates cell damage (or benefits) in its host (ASM 23d, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25).
   5. Compare and contrast commensal, symbiotic, and pathogenic relationships (ASM 23e, Ch 14).
   6. Explain what adaptations are necessary for a bacterium to survive in the respiratory tract, skin, intestinal tract, or urinary tract (ASM 23f, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23).
   7. Describe how the human microbiome influences the host human organism (ASM 23g, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23).
   8. Describe a situation that could lead to the normal microbiota causing disease (ASM 23h, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23).
   9. Given a human defense, describe a mechanism that would allow a bacterial pathogen to evade it (ASM 23i, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25).
   10. Recognize that changes in the level, location, or diversity of the normal human microbiota may lead to disease (MINAH 1, Ch 14).
   11. Recognize that knowledge of the major types of human pathogens facilitates communication among healthcare professionals (MINAH 4a, all chapters).
   12. Recognize microbiological and epidemiological features of select human pathogenic agents (e.g., etiological agent, reservoir, transmission patterns, incubation period, risk factors, potential complications, treatments, etc.) (MINAH 4b, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25).
   13. Recognize that human host factors such as age and overall health and life habits impact infectious disease development (MINAH 4c, Ch 14).
   14. Recognize that normal human microbiota includes neutral and beneficial microbes and that probiotics are increasingly recognized as beneficial in a number of health applications (MINAH 4d, Ch 14).

**Core Concept: Impact of Microorganisms**

1. Provide examples that support the concept that microbes are essential for life as we know it and the processes that support life. (ASM 24, Ch 5, Ch 6, Ch 11, Ch 14, Ch 27)
   1. Provide examples of essential microbe-microbe or microbe-host relationships (ASM 24a, Ch 14, Ch 27).
   2. Describe the role of cyanobacteria in the oxygenation of the atmosphere (ASM 24b, Ch 5, Ch 6, Ch 11, Ch 27).
   3. Describe the normal microbiota and the purposes its serve in the environment and human populations (ASM 24c, Ch 11, Ch 14, Ch 27).
   4. Predict the effect on a host organism if the normal microbiota were removed (ASM 24d, Ch 14, Ch 27).
   5. Explain the role of natural microbial populations in bioremediation/decomposition/nutrient cycling (ASM 24e, Ch 27).
2. Identify examples where microorganisms have been used as models that provided fundamental knowledge about life processes. (ASM 25, Ch 6, Ch 7, Ch 11, Ch 20)
3. Describe a key study where microbes were used as model organisms giving rise to insights about biology that are applicable across kingdoms and domains (e.g., Griffith’s transformation experiment; Avery, MacLeod, and McCarty’s transformation principle experiment; Meselson and Stahl’s semi-conservative replication; Jacob and Monod’s lac operon, etc.) (ASM 25a, Ch 7).
4. Describe the features of Escherichia coli that have made it a model organism for studying many different life processes (ASM 25b, Ch 20).
5. Explain how the rapid growth of microorganisms facilitates evolutionary studies (ASM 25c, Ch 6, Ch 11).
6. Describe how humans utilize and harness microbes and their products for medicinal purposes (ASM 26, Ch 6, Ch 8, Ch 10, Ch 26, Ch 27).
7. List four ways you have used a microbial product this week (ASM 26a, Ch 6, Ch 10, Ch 26, Ch 27).
8. List four microbial products that are used in agriculture (medicine or industry (ASM 26b, Ch 26, Ch 27).
9. Explain the importance of microbial fermentation products to food/beverage production (e.g., bread, cheese, yogurt, wine, beer, etc.) (ASM 26c, Ch 26).
10. Provide examples of how microbes can be used to solve energy problems (ASM 26d, Ch 27).
11. Discuss the benefits of two specific tools of modern biotechnology that are derived from naturally occurring microbes (e.g. cloning vectors, restriction enzymes, Taq polymerase, etc.) (ASM 26g, Ch 8).
12. List reasons why the true diversity of microbial life is largely unknown, and its effects and potential benefits have not been fully explored. (ASM 27, ASM 30, Ch 6, Ch 21, Ch 26, Ch 27).
13. Explain the great plate anomaly/viable but non-cultivatable state (ASM 27a, Ch 6).
14. Give an example of a process/product that was recently attributed to being carried out by microbes (ASM 27b, ASM 30b, Ch 21, Ch 26).
15. Discuss the beneficial impact of microbes to at least two different environments (ASM 27c, Ch 26, Ch 27).
16. Predict how the removal of microbes can negatively affect a given system (ASM 27d, Ch 14, Ch 27).

**Theory of Competencies and Skills – Scientific Thinking**

1. Apply the process of science (ASM 28, MINAH 8, MINAH 18, Ch 1).
   1. Recognize the scientific achievements of key people and events important to the history and development of microbiology (Ch 1).
   2. Identify the steps of scientific method and recognize how this method is used to answer questions (ASM 28a, MINAH 18a, Ch 1).
   3. Analyze and interpret the results of classic experiments conducted during “Golden Age” of microbiology (ASM 28b, Ch 1).
   4. Recognize the importance of Pasteur’s fermentation experiments to our world today (Ch 1).
   5. Identify the sequence of steps in Koch’s postulates and recognize how this process can be used to identify the etiological agent of certain infectious diseases (MINAH 8, Ch 1).
   6. Identify major fields of modern microbiology (Ch 1).
2. Use quantitative reasoning (ASM 29, Ch 6).
   1. Use mathematical reasoning and graphing skills to solve problems in microbiology (ASM 29a, Ch 6).
3. Ability to communicate and collaborate with other disciplines, mainly healthcare (ASM 30, Ch 19, Ch 20, Ch 21, Ch 22, Ch23, Ch 24, Ch 25).
   1. Effectively communicate concepts of microbiology in written and oral format (ASM 30b, Ch 19, Ch 20, Ch 21, Ch 22, Ch23, Ch 24, Ch 25).
4. Discuss the relationship between science and society, particularly with respect to the human aspect of medicine and clinical practice (ASM 31, MINAH 21, Ch 10, Ch 17).
5. Identify and discuss ethical issues in microbiology, especially with regard to vaccines and antimicrobial drug stewardship (ASM 31a, MINAH 21a, Ch 10, Ch 17).

**Theory of Microbiology Laboratory Skills**

1. Recognize the procedures used to prepare and view specimens for examination using bright field microscopy (ASM 32, MINAH 22, Ch 4).
2. Explain how magnification and resolution are controlled in a microscope (ASM 6g, Ch 4).
3. Recognize that staining enhances microscope resolution (Ch 4).
4. Explain the purposes of a smear preparation, heat fixation, and chemical fixation in the preparation of a specimen for microscopic viewing (Ch 4).
5. Compare and contrast uses of basic and acidic dyes in terms of ionic bonding and pH, as well as solubility-based dyes (Ch 4).
6. List and compare simple stains, differential stains, and special stain (Ch 4).
7. Recognize that examination of microorganisms with bright field microscopy can lead to presumptive identification of certain pathogens (MINAH 22b, Ch 4).
8. Recognize methods of aseptic technique for collecting and processing clinical samples, and its importance in protecting healthcare providers and patients (ASM 33, ASM 14, ASM 37, MINAH 22, MIANH 23, Ch 6).
9. Identify proper and improper laboratory procedures and biosafety measures are central for protection of laboratory personnel, healthcare providers, and patients or the general public (ASM 37, MINAH 22a, Ch 6).
10. Use standard microbiological instruments and laboratory techniques to effectively perform aseptic transfers including slants, broths, and streak plates (Ch 6).
11. Recognize terms used to describe microbial colonies on the surface of agar plates, in broth cultures, and on slant cultures (Ch 6).
12. List and describe the two most common methods by which microorganisms can be isolated for culture (MINAH 22a, Ch 6).
13. Compare and contrast six types of general culture media available for bacterial culture (Ch 6).
14. Describe enrichment culture as a means of enhancing the growth of less abundant microbes (MINAH 23b, Ch 6).
15. Describe the methods used to estimate the number of microbes in a sample using various techniques including direct count, viable plate count, spectrophotometric methods, pipetting and serial dilution (ASM 35, MINAH 23, Ch 6).
16. Compare and contrast techniques used to enumerate pathogens including direct count, viable plate count, and spectrophotometric methods) and tie results to patient prognosis and treatment (ASM 35, MINAH 23e, Ch 6).
17. Recognize how the membrane filter technique can be used to determine the bacteriologic quality of water (MINAH 23e, Ch 6).
18. Describe the use of a variety of microbiological and molecular lab equipment and methods that are key to identify pathogens and implementing effective treatment options (ASM 36, MINAH 9, MINAH 23, Ch 4, Ch 5, Ch 6, Ch 7, Ch 8, Ch 17).
19. Recognize that for nurses and other healthcare professionals to effectively explain how diagnostics work and their strengths and limitations, they will benefit from an exposure to lab equipment and methods (MINAH 23a, Ch 6, Ch 8, Ch 17).
20. List and describe general staining procedures as well as differential staining procedures like the Gram stain and acid-fast stain (MINAH 23d, Ch 4).
21. List and describe some biochemical test media that are used to identify bacterial pathogens (MINAH 9b, Ch 4, Ch 5).
22. List and describe some molecular and serological tests that are used to identify bacterial pathogens (MINAH 9a, Ch 8, Ch 17).
23. Compare and contrast techniques used to enumerate pathogens including direct count, viable plate count, and spectrophotometric methods) and tie results to patient prognosis and treatment (MINAH 23e, Ch 6).
24. Identify proper and improper laboratory procedures and biosafety measures are central for protection of laboratory personnel, healthcare providers, and patients or the general public (ASM 37, MINAH 22a, Ch 6).

**Impact of Microorganisms in Health and Disease**

1. Recognize the impacts of microorganisms on human health and the dysbiosis (imbalance) in the level, location, or diversity of the normal microbiome may lead to disease (MINAH 1).

**Microbial Pathogenicity**

1. Recognize that pathogens have diverse virulence factors that influence their pathogenesis and impact treatment options and clinical management (MINAH 6, Ch 3, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25).
2. Identify virulence factors including adhesion factors, enzymatic factors, endospores, evasion of immune responses, endotoxins, and toxins, and relate these to care planning for toxemia and sepsis/septic shock (MINAH 6a, Ch 3, Ch 14).
3. Relate pathogenesis mechanisms to identification, treatment, and reduction of disease transmission (MINAH 6b, Ch 14, Ch 19, Ch 20, Ch 21, Ch 22, Ch 23, Ch 24, Ch 25).
4. Compare and contrast the role of bacteriophages in bacterial pathogenicity including lysogeny producing specialized transduction and lytic infection producing generalized transduction (MINAH 6c, Ch 13).

**Identifying and Managing Infectious Diseases**

1. Recognize that vaccines are safe and effective methods to prevent infectious disease (MINAH 10).
2. Recognize different methods of producing and formulations of vaccines including recommended schedules of administration that are designed to optimize immunization efficacy (MINAH 10b, Ch 17).
3. Describe how vaccines allow the host immune system to acquire memory against a particular pathogen (MINAH 10a, Ch 17).
4. Describe how vaccines promote herd immunity and protect at-risk populations that cannot be vaccinated (MINAH 10c, Ch 17).
5. Recognize that nurses and other allied health workers must be able to intelligibly speak about vaccines to all stakeholders (MINAH 10d, Ch 17).

**Healthcare Associated Infections and Epidemiology**

1. Recognize that healthcare associated infections (HAIs, nosocomials) are costly and often have a poorer prognosis than community acquired infections (MINAH 11, Ch 14).
2. Recognize that Healthcare Associated Infections (HAIs) can be limited by standard/universal precautions, transmission precautions, surgical asepsis, and biosafety level precautions that are central to safely collecting and analyzing clinical samples (MINAH 11a, Ch 14).
3. Identify organizations that collaborate to track and reduce the incidence of healthcare acquired infections (MINAH 12, Ch 14).
4. Provide examples of emerging and remerging infectious agents that healthcare teams need to be prepared to manage potential outbreaks (MINAH 12a, Ch 14).
5. Identify surveillance techniques used by epidemiologists in a variety of organizations to monitor certain infectious diseases (MINAH 12a, Ch 14).
6. Recognize that an understanding of nationally notifiable diseases is essential for compliance with reporting protocols (MINAH 12b, Ch 14).
7. List several strategies (i.e., quarantine, vector control, patient education) to break the epidemiologic triangle (healthcare associated infections, antibiotic resistance, and emerging diseases) and prevent disease transmission (MINAH 13, Ch 14).

**Controlling Microbial Growth to Limit Disease**

1. Recognize that proper stewardship of antimicrobial drugs is essential to limit antimicrobial resistance (MINAH 17, Ch 10).
2. List activities associated with antimicrobial drug stewardship including testing and tracking of resistance, limitation of prescribing, and compliance with dosing regimens (MINAH 17a, Ch 10).
3. Recognize that healthcare workers must know when antimicrobial drugs are useful and why prescription compliance is essential to combat antibiotic resistance (MINAH 17b, Ch 10).

**Scientific Process and Critical Thinking Skills**

1. Use quantitative reasoning (MINAH 19, Ch 14, all chapters)
2. Draw conclusions from charts and graphs especially those related to patient history (MINAH 19a, all chapters).
3. Recognize terminology used to relate microbe levels to disease development and prognosis (i.e. lethal dose-50 and infectious dose-50) as parameter that impact morbidity and mortality (MINAH 19c, Ch 14).
4. Recognize that the ability to communicate and collaborate with other disciplines in written and oral format is important for a cross disciplinary healthcare team (MINAH 20, all chapters).
5. List and describe the top three threats in healthcare that are all related to microbiology: healthcare associated infections, antibiotic resistance, and emerging diseases (MINAH 20a, Ch 14).
6. Recognize that nurses and other allied health professionals must work effectively as individuals and in groups (MINAH 20, Ch 14).

**Microbiology Laboratory Skills**

1. Recognize protective procedures for handling infectious materials (MINAH 24, Ch 9).
2. List and describe the microbe characteristics, lab safety procedures, and emergency procedures of the four biosafety levels (MINAH 24a, Ch 9).
3. Describe proper lab waste management and recognize its importance to reduce the risk of pathogen exposure and limit infection (MINAH 24b, Ch 9).
4. Describe proper employment of personal protective equipment used as a standard part of the microbiology laboratory curriculum (MINAH 24c, Ch 9).

**9. ADOPTED TEXTBOOK(S):**

*Microbiology with Diseases by Taxonomy*

6th edition, 2020, Pearson Education Inc.

Robert W. Bauman.

ISBN: 978-0-13-517483-8 (includes Inclusive Access E-text and Mastering Access).

ISBN for students not wanting Inclusive Access: 978-0-13-574760-5 (includes Mastering and E-text).

And:

*Laboratory Experiments in Microbiology*

12th edition, 2019

Ted R. Johnson and Christine L. Case

Pearson Education, Inc.

ISBN: 978-0-13-464426-4 (includes Inclusive Access E-text and Mastering Access).

ISBN for students not wanting Inclusive Access: 978-0-13-460520-3 (includes Mastering and E-text).

**10. OTHER REQUIRED MATERIALS:**

The textbook listed above includes Modified Mastering Microbiology which is required for online homework and some exams.

Safety glasses of the type available from the Southern State Community College Bookstore must be purchased prior to the second lab session.

**11. GRADING\*\*\*:**

Grading will follow policy in college catalog.

**A 90 – 100**

**B 90 – 89**

**C 70 – 79**

**D 60 – 69**

**F 0 – 59**

**12. GRADING PROCEDURES OR ASSESSMENTS (*Course Syllabus – Individual Instructor Specific)*):**

**Grades will be based on:**

Chapter Reading Activities 200 points 40%

Chapter Review Quizzes 50 points 10%

3 Exams (@ 100 points each, drop low score) 200 points 40%

Lab Safety Quiz 25 points 5%

Lab Reports 300 points 60%

Unknowns Lab 100 points 20%

Comprehensive Exam 100 points 10%

Total 500 points 100%

**13. COURSE METHODOLOGY: *(Course Syllabus – Individual Instructor Specific)***

This course will use lecture, discussion, power point and video presentations. Web based tutorials and learning exercises will be referenced and can be used at the discretion of the student. The course will include chapter assignments and review quizzes. Lecture exams will be used as appropriate to verify achievement of the course objectives and do determine grades.

**14. COURSE OUTLINE: (Course Syllabus -= Individual Instructor Specific)**

**Sample lecture outline:**

1. History of microbiology.
2. Biological chemistry.
3. Cell structure and function.
4. Microscopy and classification of organisms.
5. Microbial metabolism.
6. Microorganism nutrition and growth.
7. Microbial genetics.
8. Biotechnology.
9. Controlling microorganism growth outside the body.
10. Controlling microorganism growth inside the body.
11. Classification and standard growth curve of prokaryotes.
12. Classification and unique characteristics of eukaryotes.
13. Classification and replication of viruses.
14. Normal microbial flora, human health, and infectious disease.
15. Innate immunity.
16. Adaptive immunity.
17. Immunization and serologic testing.
18. Immune disorders.
19. Infectious diseases caused by Gram positive bacteria.
20. Infectious diseases caused by Gram negative bacteria.
21. Infectious diseases caused by other types of bacteria.
22. Infectious diseases caused by fungi.
23. Infectious diseases caused by other eukaryotic microorganisms and worms.
24. Infectious diseases caused by RNA viruses.
25. Infectious diseases caused by DNA viruses.

**Sample Course Calendar**

Week 1 History of microbiology.

Biological chemistry.

Week 2 Cell structure and function.

Microscopy and classification of organisms.

Week 3 Microbial metabolism.

Microorganism nutrition and growth.

Week 4 Microbial genetics.

Biotechnology.

Week 5 Controlling microorganism growth outside the body.

Controlling microorganism growth inside the body.

Week 6 Review week and Exam 1.

Classification and standard growth curve of prokaryotes.

Classification and unique characteristics of eukaryotes.

Week 7 Classification and replication of viruses.

Normal microbial flora, human health, infectious disease.

Week 8 Exam 2.

Innate immunity.

Week 9 Adaptive immunity

Adaptive immunity and Immunization.

Week 10 Immunization and serologic testing.

Immune disorders.

Week 11 Exam 3.

Infectious diseases caused by Gram positive bacteria.

Week 12 Infectious diseases caused by Gram negative bacteria.

Infectious diseases caused by other types of bacteria.

Week 13 Infectious diseases caused by fungi.

Infectious diseases caused by other eukaryotes.

Week 14 Infectious diseases caused by RNA viruses.

Infectious diseases caused by DNA viruses.

Week 15 Review and infectious diseases activity.

Week 16 Comprehensive Exam

**Sample lab outline:**

1. Lab Safety and Microbes in the Environment
2. Microscopy and Transfer of Bacteria
3. Cultivation of Bacteria and Staining Methods
4. Microbial Metabolism
5. Microbial Growth and the Environment
6. Microbial Genetics and Control
7. The Microbial World
8. Viruses and Epidemiology
9. Immunology
10. Serology Testing including ELISA
11. Bacteria of the Skin, Respiratory Tract, and Mouth
12. Bacteria of the Gastrointestinal and Genitourinary Tracts
13. Unknown Identification and Bergey's Manual
14. Identification of Unknowns
15. Presentation of Unknowns
16. Lab Exam

**SAMPLE** Course Calendar

Week 1 Lab #1 – Lab Safety and Microbes in the Environment

Week 2 Lab #2 – Microscopy and Handling Bacteria

Week 3 Lab Safety Quiz

Lab #3 – Cultivation of Bacteria and Staining Methods

Week 4 Lab #4 – Microbial Metabolism and

Week 5 Lab #5 – Growth and the Environment

Week 6 Lab #6 – Microbial Genetics and Control

Week 7 Lab #7 – The Microbial World

Week 8 Lab #8 – Viruses and Epidemiology

Week 9 Lab #9 – Immunology

Week 10 Lab #10 – Serology Testing including ELISA

Week 11 Lab #11 – Bacteria of the Skin, Respiratory Tract, and Mouth

Week 12 Lab #12 – Bacteria of the Gastrointestinal and Genitourinary Tracts

Week 13 Lab #13 – Unknown Identification and Bergey's Manual

Week 14 Lab #14 – Identification of Unknowns

Week 15 Lab #15 – Presentation of Unknowns

Week 16 Lab Exam

**15. SPECIFIC MANAGEMENT REQUIREMENTS\*\*\*:**

Final grade in this course will be determined by mastery of course material as assessed by quizzes, tests, exams, and other assignments.

**16.** **FERPA:\***

Students need to understand that their work may be seen by others. Others may see your work when being distributed, during group project work, or if it is chosen for demonstration purposes. Students also need to know that there is a strong possibility that your work may be submitted to other entities for the purpose of plagiarism checks.

**17. ACCOMMODATIONS:**

Students requesting accommodations may contact Ryan Hall, Accessibility Coordinator at rhall21@sscc.edu or 937-393-3431, X 2604.

Students seeking a religious accommodation for absences permitted under Ohio’s Testing Your Faith Act must provide the instructor and the Academic Affairs office with written notice of the specific dates for which the student requires an accommodation and must do so no later than fourteen (14) days after the first day of instruction or fourteen (14) days before the dates of absence, whichever comes first. For more information about Religious Accommodations, contact Ryan Hall, Accessibility Coordinator at [rhall21@sscc.edu](mailto:rhall21@sscc.edu) or 937-393-3431 X 2604.

**18. OTHER INFORMATION\*\*\*:**