Microbiology

Course Materials

- Cowan, Marjorie Kelly and Heidi Smith. Microbiology: A Systems Approach. 5th Edition. McGraw-Hill, 2018. ISBN: 9781259706615

Course Description

This course is designed to teach microbiology as it applies to the health care field. We will study pathogenic microorganisms and their role in human disease, human immunology, symptoms and treatment of microbial infection, and preventative measures against microbial infection.

Course Objectives

To provide an understanding of recognition, treatment and prevention of microbial pathogenesis.

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

- Describe the basic characteristics, and classify the microorganisms studied.
- Understand the interaction between the microbe and host
- Describe the symptoms, causative agent, pathogenesis, epidemiology, prevention and treatment for the infectious diseases studied.

Course Prerequisites

There are no prerequisites to take Microbiology; however StraighterLine does suggest that you have successfully completed a college level Biology course such as Biology for Non-Majors (BIO101) by StraighterLine.

Important Terms

In this course, different terms are used to designate tasks:

- **Proctoring**: all final exams require proctoring which can be completed conveniently from your home. A webcam is required.
- **Tutoring**: memberships include online tutoring for students to access with any content/subject related questions in the place of faculty. If your tutor is not able to answer your questions please contact a student advisor.
- **Review Activities**: These are non-graded, unassessed assignment and activities from your text which help reinforce course learning objectives and practice the skills discussed in a topic.

- **Graded Quiz**: These are shorter graded, timed quizzes based on individual topics.
- **Exam**: A graded, timed online test.

Course Evaluation Criteria

StraighterLine provides a percentage score and letter grade for each course. See Academic Questions section in FAQ for further details on percentage scores and grading scale. A passing percentage is **70%** or higher.

If you have chosen a Partner College to award credit for this course, your final grade will be based upon that college's grading scale. Only passing scores will be considered by Partner Colleges for an award of credit.

There are a total of 1000 points in the course:

Topic	Assessment	Points Available
3	Graded Exam 1	90
6	Graded Exam 2	90
9	Graded Exam 3	90
9	Midterm Exam	160
15	Graded Exam 4	90
21	Graded Exam 5	90
24	Graded Exam 6	90
25	Final Graded Exam	300
Total		1000

Course Topics and Objectives

Unit	Title	Subunit/Topic	Objectives
1	Themes of Microbiology	• The Scope of Microbiology • The Impact of Microbes on Earth: Small Organisms with a Giant Effect • Human Use of Microorganisms • Infectious Diseases and the Human Condition • The General	• List the various types of microorganisms. • Identify multiple types of professions using microbiology. • Describe the role and impact of microbes on earth. • Explain the theory of evolution and why it is called a theory. • Explain the ways that humans manipulate organisms for their own uses. • Summarize the relative burden of

		Characteristics of Microorganisms • The Historical Foundations of Microbiology • Naming, Classifying, and Identifying Microorganisms	human disease caused by microbes. • Differentiate between prokaryotic and eukaryotic microorganisms. • Identify a third type of microorganism. • Compare and contrast the relative sizes of the different microbes. • Make a time line of the development of microbiology from the 1600s to today. • List some recent microbiology discoveries of great impact. • Explain what is important about the scientific method. • Differentiate between the terms nomenclature, taxonomy, and classification. • Create a mnemonic device for remembering the taxonomic categories. • Correctly write the binomial name for a microorganism. • Draw a diagram of the three major domains. • Explain the difference between traditional and molecular approaches to taxonomy.
2	Chemistry of Biology	• Atoms, Bonds, and Molecules: Fundamental Building Blocks • Macromolecules: Superstructures of Life • Cells: Where Chemicals Come to Life	• Explain the relationship between atoms and elements. • List and define four types of chemical bonds. • Differentiate between a solute and a solvent. • Give a brief definition of pH. • Name the four main families of biochemicals. • Provide examples of cell components made from each of the families of biochemicals. • Explain primary, secondary, tertiary, and quaternary structure as seen in proteins. • List the three components of nucleic acids. • Name the nucleotides of DNA and of RNA. • List the three components of ATP. • Point out three characteristics all cells share.

3	Tools of the Laboratory	• Methods of Culturing Microorganisms: The Five I's • The Microscope: Window on an Invisible Realm	• Explain what the five I's mean and what each step entails. • Name and define the three ways to categorize media. • Provide examples for each of the three categories of media. • Convert among different lengths within the metric system. • Describe the earliest microscopes. • List and describe the three elements of good microscopy. • Differentiate between the principles of light and electron microscopy. • Name the two main categories of stains. • Give examples of a simple, differential, and special stain.
4	Prokaryotic Profiles	• Prokaryotic Form and Function • External Structures • The Cell Envelope: The Boundary Layer of Bacteria • Bacterial Internal Structure • Prokaryotic Shapes, Arrangements, and Sizes • Classification Systems in the Prokaryotae • The Archaea	• Name the structures all bacteria possess. • Name at least four structures that some, but not all, bacteria possess. • Describe the structure and function of four different types of bacterial appendages. • Explain how a flagellum works in the presence of an attractant. • Differentiate between the two main types of bacterial envelope structure. • Discuss why gram-positive cell walls are stronger than gram-negative cell walls. • Name a substance in the envelope structure of some bacteria that can cause severe symptoms in humans. • Identify five things that might be contained in bacterial cytoplasm. • Detail the causes and mechanisms of sporogenesis and germination. • Describe the three major shapes of prokaryotes. • Describe other more unusual shapes of prokaryotes. • Differentiate between Bergey's Manual of Systematic Bacteriology and Bergey's Manual of Determinative Bacteriology. • Name four divisions ending in –cutes and describe their characteristics. • Explain what a species is. • List some differences between

			archaea and bacteria.
5	Eukaryotic Cells and Microorganisms	• The History of Eukaryotes • Form and Function of the Eukaryotic Cell: External Structures • Form and Function of the Eukaryotic Cell: Internal Structures • The Kingdom of the Fungi • The Protists • The Parasitic Helminths	• Relate both prokaryotic and eukaryotic cells to the Last Common Ancestor. • List the types of eukaryotic microorganisms and denote which are unicellular and which are multicellular. • Differentiate between cilia and flagella in eukaryotes, and between flagella in prokaryotes and eukaryotes. • Describe the important characteristics of a glycocalyx in eukaryotes. • List which eukaryotic microorganisms have a cell wall. • List similarities and differences between eukaryotic and prokaryotic cytoplasmic membranes. • Describe the important component parts of a nucleus. • Diagram how the nucleus, endoplasmic reticulum, and Golgi apparatus, together with vesicles, act together. • Explain the function of the mitochondria. • Discuss the function of chloroplasts and explain which cells contain them and why. • Explain the importance of ribosomes and differentiate between eukaryotic and prokaryotic types. • List and describe the three main fibers of the cytoskeleton. • List some general features of fungal anatomy. • Differentiate among the terms heterotroph, saprobe, and parasite. • Connect the concepts of fungal hyphae and a mycelium. • Describe two ways in which fungal spores arise. • List two detrimental and two beneficial activities of fungi (from the viewpoint of humans). • Use protozoan characteristics to explain why they are informally placed into a single group. • List three means of locomotion by protozoa. • Explain why a cyst stage might be

			useful. • Give an example of a disease caused by each of the four types of protozoa. • List the two major groups of helminths and then the two subgroups of one of these groups. • Describe a typical helminth lifestyle.
6	Introduction to the Viruses	• The Search for the Elusive Viruses • The Position of Viruses in the Biological Spectrum • The General Structure of Viruses • How Viruses Are Classified and Named • Modes of Viral Multiplication • Techniques in Cultivating and Identifying Animal Viruses • Medical Importance of Viruses • Other Noncellular Infectious Agents • Treatment of Animal Viral Infections	• Describe the significance of viruses being recognized as "filterable." • Construct arguments on both sides of the "Are viruses living?" debate. • Identify better terms for viruses than "alive" or "dead." • Discuss the size of viruses relative to other microorganisms. • Describe the function and structure(s) of viral capsids. • Distinguish between enveloped and naked viruses. • Explain the importance of viral surface proteins, or spikes. • Diagram the possible configurations of nucleic acid viruses may possess. • Explain why some find it difficult to assign species names to viruses. • Demonstrate how family and genus names in viruses are written. • Diagram the five-step life cycle of animal viruses. • Explain what cytopathic effects are. • Discuss both persistent and transforming infections. • Provide a thorough description of lysogenic and lytic bacteriophage infections. • List the three principal purposes of cultivating viruses. • Describe three ways in which viruses are cultivated. • Analyze the relative importance of viruses in human infection and disease. • Name at least three noncellular infectious agents besides viruses. • Discuss the primary reason that antiviral drugs are more difficult to design than antibacterial drugs.
7	Microbial Nutrition, Ecology and Growth	• Microbial Nutrition • Environmental Factors That	• List the essential nutrients of a bacterial cell.

		Influence Microbes • The Study of Microbial Growth	• Differentiate between macronutrients and micronutrients. • Construct four different terms that describe an organism's sources of carbon and energy. • Define saprobe and parasite. • Discuss diffusion and osmosis. • Identify the effects on a cell of isotonic, hypotonic, and hypertonic conditions. • Name two types of passive transport and three types of active transport. • Name five types of bacteria based on their temperature preferences. • Explain how different organisms deal with oxygen. • Name three other physical factors that microbes must contend with. • List and describe the five types of associations microbes can have with their hosts. • Discuss characteristics of biofilms that differentiate them from planktonic bacteria. • Describe the major way that bacteria divide; name another way used by fewer bacteria. • Define doubling time and how it relates to exponential growth. • Compare and contrast the four phases of growth in a bacterial growth curve. • Identify three methods besides a growth curve to count bacteria.
8	Microbial Metabolism	• The Metabolism of Microbes • The Pursuit and Utilization of Energy • The Pathways • Biosynthesis and the Crossing Pathways of Metabolism • It All Starts with Light	• Describe the relationship among metabolism, catabolism, and anabolism. • Fully define the structure and function of enzymes. • Differentiate between an apoenzyme and a holoenzyme. • Differentiate between endoenzyme and exoenzyme, and between constitutive and regulated enzymes. • Diagram some different patterns of metabolism. • Describe how enzymes are controlled. • Name the chemical in which energy is stored in cells. • Create a general diagram of a redox reaction.

			• Identify electron carriers used by cells. • Name three basic catabolic pathways and give an estimate of how much ATP each of them yields. • Write a summary statement describing glycolysis. • Describe the Krebs cycle. • Discuss the significance of the electron transport system. • Point out how anaerobic respiration differs from aerobic respiration. • Provide a summary of fermentation. • Describe how noncarbohydrate compounds are catabolized. • Provide an overview of the anabolic stages of metabolism. • Define amphibolism. • Summarize the process of photosynthesis in simple language. • Discuss the relationship between light-dependent and light-independent reactions. • Explain where the Calvin cycle fits into photosynthesis. • Speculate on the importance of the discovery of photosynthetic bacteria on the ocean floor.
9	Microbial Genetics	• Introduction to Genetics and Genes: Unlocking the Secrets of Heredity • Applications of the DNA Code: Transcription and Translation • Genetic Regulation of Protein Synthesis • Mutations: Changes in the Genetic Code • DNA Recombination Events	• Define the terms genome and gene. • Differentiate between genotype and phenotype. • Draw a picture of a length of DNA, including all important chemical groups. • Explain how DNA replication takes place. • Use Okazaki fragments to explain leading and lagging strands. • Relate the new and old versions of the "central dogma." • Identify important differences between RNA and DNA. • Draw a picture of the process of transcription. • List the three types of RNA directly involved in translation. • Define "codon" and "anticodon." • Identify on which molecules the promoter, the start codon, and the A and P sites appear.

			• Indicate how eukaryotic transcription and translation differ from these processes in prokaryotes. • List one or two important advantages to arranging genes in an operon. • Differentiate between repressible and inducible operons. • Name some antibiotic targets of the transcription and translation machinery. • Define the term "mutation" and discuss its importance. • Differentiate among frameshift, nonsense, silent, and missense mutations. • Define recombinant. • Describe three forms of horizontal gene transfer used in bacteria.
10	Physical and Chemical Control of Microbes	• Controlling Microorganisms • Methods of Physical Control • Chemical Agents in Microbial Control •	• Distinguish among the terms sterilization, disinfection, antisepsis, and decontamination. • Identify the microorganisms that are most resistant and least resistant to control measures. • Define "-static" and "-cidal." • Name four categories of cellular targets for physical and chemical agents. • Name six methods of physical control of microorganisms. • Discuss both moist and dry heat methods and identify multiple examples of both. • Define thermal death time and thermal death point. • Explain four different methods of moist heat control. • Explain two methods of dry heat control. • Identify advantages and disadvantages of cold and dessication. • Differentiate between the two types of radiation control methods. • Explain how filtration functions as a control method. • Identify some common uses of osmotic pressure as a control method. • Name the desirable characteristics of chemical control agents. • Discuss several different halogen

			agents and their uses. • List advantages and disadvantages to phenolic compounds. • Explain the mode of action of alcohols. • Pinpoint the most appropriate applications of hydrogen peroxide agents. • Define surfactant and explain its mode of action. • Identify some heavy metal control agents and their most common applications. • Discuss the advantages and disadvantages of aldehyde agents. • Identify applications for ethylene oxide sterilization.
11	Drugs, Microbes, Host	• Principles of Antimicrobial Therapy • Interactions Between Drug and Microbe • Survey of Major Antimicrobial Drug Groups • Interactions Between Drug and Host • Considerations in Selecting an Antimicrobial Drug	• State the main goal of antimicrobial treatment. • Identify the sources for most currently used antimicrobials. • Explain the concept of selective toxicity. • List the five major targets of antimicrobial agents. • Identify which categories of drugs are most selectively toxic and why. • Explain how drugs that inhibit protein synthesis can be selective. • Define metabolic analog and discuss its relevance to antimicrobial action. • Distinguish between broad-spectrum and narrow-spectrum antimicrobials and explain the significance of the distinction. • Trace the evolution of penicillin antimicrobials, and identify which microbes they are effective against. • Explain the significance of beta-lactamases, and where they are found. • List other beta-lactam classes of antibiotics and give two examples. • List some cell wall antibiotics that are not in the beta-lactam category. • Identify two older and two newer antimicrobials that act by inhibiting protein synthesis. • Explain how drugs targeting folic acid synthesis work.

			• Identify the cellular target of quinolones and name two examples. • Name two drugs that target the cellular membrane. • Discuss how treatment of biofilm infections differs from that of nonbiofilm infections. • Name the four main categories of antifungal agents and provide one example of each. • Name four antiprotozoal drugs and three antihelminthic drugs. • List the two major modes of actions of antiviral drugs. • Discuss two possible ways that microbes acquire antimicrobial resistance. • List five cellular or structural mechanisms that microbes use to resist antimicrobials. • Discuss at least four novel antimicrobial strategies that are under investigation. • Distinguish between drug toxicity and allergic reactions to drugs. • Explain what a superinfection is and how it occurs. • Describe two methods for testing antimicrobial susceptibility. • Define therapeutic index and identify whether a high or a low index is preferable.
12	Microbe-Human Interactions	• The Human Host • The Progress of an Infection • Epidemiology: The Study of Disease in Populations	• Differentiate between colonization, infection, and disease. • Enumerate the sites where normal biota is found in humans. • Discuss how the Human Microbiome Project will change our understanding of normal biota. • Point out how microbial antagonism can be helpful to the human host. • Differentiate between pathogenicity and virulence. • Define opportunism. • List the steps a microbe has to take to get to the point where it can cause disease. • List several portals of entry. • Define infectious dose. • Describe three ways microbes cause

			tissue damage. • Differentiate between endotoxins and exotoxins. • Provide a definition of virulence factors. • Draw and label a curve representing the course of clinical infection. • Discuss the topic of reservoirs thoroughly. • List seven different modes of transmission of infectious agents. • Define nosocomial infection and list the three most common types. • List Koch's postulates, and when they might not be appropriate in establishing causation. • Differentiate the science of epidemiology from traditional medical practice. • Identify the need for some diseases being denoted "notifiable." • Define incidence and prevalence. • Discuss point-source, common-source, and propagated epidemics and predict the shape of the epidemic curves associated with each.
13	Host Defenses	• Defense Mechanisms of the Host in Perspective • The Second and Third Lines of Defense: An Overview • Systems Involved in Immune Defenses • The Second Line of Defense • Specific Immunity: The Third and Final Line of Defense • Step I: Lymphocyte Development • Step II: Presentation of Antigens	• Summarize what the three lines of defense are. • Identify three components of the first line of defense. • Define marker, and discuss its importance in the second and third lines of defense. • Name four body compartments that participate in immunity. • List the components of the reticuloendothelial system. • Fully describe the structure and function of the lymphatic system. • Differentiate between whole blood and plasma. • Name six kinds of blood cells that function in nonspecific immunity, and the most important function of each. • Name two kinds of lymphocytes involved in specific immunity. • List the four major categories of nonspecific immunity. • Outline the steps in inflammation.

		• Steps III and IV: B-Cell Response • Steps III and IV: T-Cell Response • Specific Immunity and Vaccination	• Outline the steps in phagocytosis. • Discuss the mechanism of fever and what it accomplishes. • Name four types of antimicrobial proteins. • Compose one good overview sentence about the purpose and the mode of action of the complement system. • Describe how the third line of defense is different from the other two. • List the four stages of a specific immune response. • Discuss four major immune functions of cell markers. • Describe the major histocompatibility complex in two sentences. • Contrast the way T cells recognize antigen with the way B cells do. • Summarize the maturation process of both B cells and T cells. • Explain how our bodies are equipped with lymphocytes capable of responding to nearly any antigen imaginable. • Outline the processes of clonal selection and expansion. • Describe the B-cell receptor and the T-cell receptor. • Compare the terms antigen, immunogen, and epitope. • List characteristics of antigens that optimize their immunogenicity. • List the types of cells that can act as antigen-presenting cells. • Diagram the steps in the B-cell response. • Make a detailed drawing of an antibody molecule. • Explain the various end results of antibody binding to an antigen. • List the five types of antibodies and important facts about each. • Describe the memory response. • List the three major types of cells T cells will differentiate into after stimulation. • Describe the main functions of these three types of T cells. • Explain how TC cells kill other cells. • List and define the four different descriptors of specific immune states.

			• Discuss the qualities of an effective vaccine. • Name the two major categories of vaccines and then the subcategories under each. • Discuss the pros and cons of killed (or inactivated) versus attenuated vaccines. • Describe the principle behind DNA vaccines. • Explain the principle of herd immunity.
14	Disorders in Immunity	• The Immune Response: A Two-Sided Coin • Type I Allergic Reactions: Atopy and Anaphylaxis • Type II Hypersensitivities : Reactions That Lyse Foreign Cells • Type III Hypersensitivities : Immune Complex Reactions • Type IV Hypersensitivities : Cell-Mediated (Delayed) Reactions • An Inappropriate Response Against Self: Autoimmunity • Immunodeficiency Diseases: Hyposensitivity of the Immune System	• Name the two major categories of immune dysfunction. • Identify the four types of overreaction to antigens. • Define allergen and distinguish among inhalant, ingestant, and contactant types. • Describe the sequence of events after secondary exposures to allergens. • Explain why systemic anaphylaxis is so serious. • Briefly describe two methods for diagnosing allergies. • Discuss the mechanism of action of "allergy shots." • List the major immune system components involved in type II hypersensitivity. • Explain the basis for the ABO blood groups, and what type of antibody to the ABO antigens different individuals might have. • Identify which blood types are considered universal donors and universal recipients. • Explain under what circumstance the Rh factor can be problematic for newborn babies. • Specify how type III hypersensitivity is similar to, and also different from, type II hypersensitivity. • Provide highlights about the Arthus reaction and serum sickness. • Describe the pathogenesis of contact dermatitis. • Provide the names for four different sources of graft material. • Name and describe at least three

			different theories of autoimmunity. • Describe the pathogenesis of at least three autoimmune diseases. • Distinguish between primary and secondary immunodeficiencies. • Explain what severe combined immunodeficiency is and discuss currently available therapeutic approaches. • Name three conditions that can cause secondary immunodeficiencies.
15	Diagnosing Infections	• Preparation for the Survey of Microbial Diseases • On the Track of the Infectious Agent: Specimen Collection • Phenotypic Methods • Genotypic Methods • Immunologic Methods	• Name the three major categories of microbe identification techniques. • Identify some important considerations about collecting samples from patients for microbial identification. • Explain the ideas behind presumptive versus confirmatory data. • List at least three different tests that fall in the direct identification category. • Explain the main principle behind biochemical tests. • List the major steps in a hybridization method of microbe identification. • Provide an explanation for how PCR is useful for infectious disease diagnosis. • Give a thorough definition of the term serology. • Differentiate between sensitivity and specificity. • Discuss the concepts of agglutination and precipitation and when each is appropriate. • List the steps of a Western blot. • Describe how complement fixation works. • List the steps of an ELISA and explain the difference between a direct and an indirect test.
16	Infectious Diseases (Skin and Eyes)	• The Skin and Its Defenses • Normal Biota of the Skin • Skin Diseases Caused by Microorganisms • The Surface of	• Describe the important anatomical features of the skin. • List the natural defenses present in the skin. • List the types of normal biota presently known to occupy the skin. • List the possible causative agents, modes of transmission, virulence

		the Eye and Its Defenses • Normal Biota of the Eye • Eye Diseases Caused by Microorganisms	factors, diagnostic techniques, and prevention/treatment for each of the diseases of the skin. These are: acne, impetigo, cellulitis, staphylococcal scalded skin syndrome, gas gangrene, vesicular/pustular rash diseases, maculopapular rash diseases, wartlike eruptions, large pustular skin lesions, and cutaneous mycoses. • Discuss the spectrum of skin and tissue diseases caused by Staphylococcus aureus and Streptococcus pyogenes. • Provide an update of the status of MRSA infections in the United States. • Discuss the relative dangers of rubella and rubeola viruses in different populations. • Describe the important anatomical features of the eye. • List the natural defenses present in the eye. • List the types of normal biota presently known to occupy the eye. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/ treatment for each of the diseases of the eye. These are: conjunctivitis, trachoma, keratitis, and river blindness.
17	Infectious Diseases (Nervous System)	• The Nervous System and Its Defenses • Normal Biota of the Nervous System • Nervous System Diseases Caused by Microorganisms	• Describe the important anatomical features of the nervous system. • List the natural defenses present in the nervous system. • Talk about the normal biota of the nervous system and the background behind it. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for meningitis and also for neonatal meningitis. • Identify the most common and also the most deadly of the multiple possible causes of meningitis. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for diseases

			most directly involving the brain. These are: meningoencephalitis, encephalitis, and subacute encephalitis. • Identify which encephalitis-causing viruses you should be aware of in your geographical area. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for other diseases in the nervous system. These are: rabies, poliomyelitis, tetanus, botulism, and African sleeping sickness. • Explain the difference between the oral polio vaccine and the inactivated polio vaccine and under which circumstances each is appropriate.
18	Infectious Diseases (Cardiovascular and Lymphatic Systems)	• The Cardiovascular and Lymphatic Systems and Their Defenses • Normal Biota of the Cardiovascular and Lymphatic Systems • Cardiovascular and Lymphatic System Diseases Caused by Microorganisms	• Describe the important anatomical features of the cardiovascular system. • List the natural defenses present in the cardiovascular system. • Discuss the "what" and the "why" of the normal biota of the cardiovascular system. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for the two forms of endocarditis. • Discuss what series of events may lead to septicemia and how it should be prevented and treated. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for cardiovascular system infections that have only one infectious cause. These are: plague, tularemia, Lyme disease, and infectious mononucleosis. • Discuss factors that distinguish hemorrhagic and nonhemorrhagic fever diseases. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for hemorrhagic fever diseases.

			• List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for nonhemorrhagic fever diseases. • Discuss all aspects of malaria, with special emphasis on epidemiology. • Describe what makes anthrax a good agent for bioterrorism and list the important presenting signs to look for in patients. • Discuss how the epidemiology of HIV infection in the United States has changed over time and why. • Discuss the epidemiology of HIV infection in the developing world
19	Infectious Diseases (Respiratory System)	• The Respiratory Tract and Its Defenses • Normal Biota of the Respiratory Tract • Upper Respiratory Tract Diseases Caused by Microorganisms • Diseases Caused by Microorganisms Affecting Both the Upper and Lower Respiratory Tracts • Lower Respiratory Tract Diseases Caused by Microorganisms	• Draw or describe the anatomical features of the respiratory tract. • List the natural defenses present in the respiratory tract. • List the types of normal biota presently known to occupy the respiratory tract. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for each of the diseases of the upper respiratory tract. These are: rhinitis, sinusitis, otitis media, pharyngitis, and diphtheria. • Identify which disease is often caused by a mixture of microorganisms. • Identify two bacteria that can cause dangerous pharyngitis cases. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for each of the diseases infecting both the upper and lower respiratory tracts. These are: pertussis, RSV disease, and influenza. • Compare and contrast antigenic drift and antigenic shift in influenza viruses. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for each of the diseases infecting the lower

			respiratory tract. These are: tuberculosis, community-acquired pneumonia, and nosocomial pneumonia. • Discuss the problems associated with MDR-TB and XDR-TB. • Demonstrate an in-depth understanding of the epidemiology of tuberculosis infection. • Describe the importance of the recent phenomenon of cold viruses causing pneumonia. • List the distinguishing characteristics of nosocomial versus community-acquired pneumonia.
20	Infectious Diseases (Gastrointestinal Tract)	• The Gastrointestinal Tract and Its Defenses • Normal Biota of the Gastrointestinal Tract • Gastrointestinal Tract Diseases Caused by Microorganisms (Nonhelminthic) • Gastrointestinal Tract Diseases Caused by Helminths	• Draw or describe the anatomical features of the gastrointestinal tract. • List the natural defenses present in the gastrointestinal tract. • List the types of normal biota presently known to occupy the gastrointestinal tract. • Describe how our view has changed of normal biota present in the stomach. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for each of the kinds of oral diseases. • Discuss current theories about the connection between oral bacteria and cardiovascular disease. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for mumps, gastritis, and gastric ulcers. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for acute and chronic diarrhea, and also for acute diarrhea with vomiting. • Differentiate among the main types of hepatitis and discuss each causative agent, mode of transmission, diagnostic techniques, prevention, and treatment of each. • Describe some distinguishing characteristics and commonalities

			seen in helminthic infections. • List four helminths that cause primarily intestinal symptoms, and identify which life cycle they follow and one unique fact about each one. • List four helminths that cause intestinal symptoms that may be accompanied by migratory symptoms, and identify which life cycle they follow and one unique fact about each one. • List the modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for each of the helminth infections resulting in liver and intestinal symptoms. These are infections caused by Opisthorchis sinensis, Clonorchis sinensis, and Fasciola hepatica. • Describe the type of disease caused by Trichinella species. • Diagram the life cycle of Schistosoma mansoni and S. japonicum, discuss how it differs from the life cycle of the Schistosoma involved in urinary disease, and describe the importance of all three organisms in world health.
21	Infectious Diseases (Genitourinary System)	• The Genitourinary Tract and Its Defenses • Normal Biota of the Genitourinary Tract • Urinary Tract Diseases Caused by Microorganisms • Reproductive Tract Diseases Caused by Microorganisms	• Draw or describe the anatomical features of the genitourinary tracts of both genders. • List the natural defenses present in the genitourinary tracts. • List the types of normal biota presently known to occupy the genitourinary tracts of both genders. • List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for each type of urinary tract infection (including leptospirosis and schistosomiasis). • Distinguish between vaginitis and vaginosis. • Discuss prostatitis. • List the possible causative agents, modes of transmission, virulence factors, and prevention/treatment for gonorrhea and Chlamydia infection. • Name three diseases that result in

			genital ulcers and discuss their important features. • Differentiate between the two diseases causing warts in the reproductive tract. • Provide some detail about the first "cancer vaccine" and how it works. • Identify the most important risk group for group B Streptococcus infection and why.
22	Environmental Microbiology	• Ecology: The Interconnecting Web of Life • The Natural Recycling of Bioelements • Microbes on Land and in Water	• Define microbial ecology. • Summarize why our view of the abundance of microbes on earth has changed in recent years. • Discuss the terms ecosystem and community in relation to one another. • Differentiate between habitat and niche. • Draw an example of an energy pyramid, labeling producers and consumers. • Define bioremediation. • List five important elements of biogeochemical cycles. • Diagram a carbon cycle. • Point out where methanogens influence the carbon cycle. • List the four reactions involved in the nitrogen cycle. • Describe the process of nitrogen fixation, and provide some examples of organisms that perform it. • Give brief summaries of the sulfur and phosphorus cycles. • Outline the basic process used to perform metagenomic analysis of the environment. • List two important partnerships that occur in the soil. • Diagram the hydrologic cycle. • Discuss what metagenomic sampling of oceans has revealed. • Name the regions, top to bottom, of large bodies of standing water. • Define eutrophication and discuss its consequences.
23	Applied Microbiology and Water	• Applied Microbiology and Biotechnology	• Define biotechnology. • Compose a sentence about the history of applied microbiology.

	Safety	• Microorganisms in Water and Wastewater Treatment • Microorganisms Making Food and Spoiling Food • Using Microorganisms to Make Things We Need	• Outline the steps in water purification. • Differentiate water purification from sewage treatment. • Describe the primary and secondary phases of sewage treatment. • List five important pathogens of drinking water. • Explain why indicator bacteria are used as surrogates for pathogenic bacteria in examination of water safety. • Discuss the relevance of fecal coliforms. • Name five foods and/or beverages that benefit from microbial fermentation. • Explain what microbial actions lead to leavening in bread. • Write the equation for turning yeast and sugar into alcoholic beverages. • Discuss why microorganisms themselves might be useful as food products. • Provide some background about HACCP procedures. • Report 10-year trends in food-borne illness. • Outline basic principles of using temperature to preserve food. • List mechanisms other than temperature that are used to preserve food. • State the general aim(s) of industrial microbiology. • Distinguish between primary and secondary metabolites. • List the four steps of industrial product production from microbes. • List five different types of substances produced from industrial microbiology, and their applications.
24	Genetic Engineering and Recombinant DNA	• Basic Elements and Applications of Genetic Engineering • Tools and Techniques of Genetic Engineering • Methods in	• Provide examples of practical applications of genetic manipulation. • Explain the importance of restriction endonucleases to genetic engineering. • Describe how gel electrophoresis helps in the analysis of DNA. • Discuss Southern blots and how gene probes figure in them. • Outline the process of DNA

		Recombinant DNA Technology: How to Imitate Nature • Biochemical Products of Recombinant DNA Technology • Genetically Modified Organisms • Genetic Treatments: Introducing DNA into the Body • Genome Analysis: Maps and Profiles	sequencing. • List the steps in the polymerase chain reaction. • Describe how you can clone a gene into a bacterium. • Define recombinant in the context of this chapter. • Provide several examples of recombinant products that have contributed to human health. • Compare and contrast recombinant bacteria, plants, and animals. • Differentiate between somatic and germline gene therapy. • Describe at least two gene silencing strategies. • Outline the general steps in DNA profiling. • Discuss the significance of single nucleotide polymorphisms (SNPs). • Describe the utility of DNA microarray analysis.
25	Review	• Review	• Review and Final Examination