

# **Jordan University of Science and Technology**

## **Faculty of Medicine 2018-2019**

**COURSE TITLE :** General Microbiology

**COURSE CODE :** MED 265.

**CREDIT HOURS :** 3 Credit hours

**SEQUENCE :** YEAR 2, FIRST SEMESTER

**COURSE COORDINATOR:** Dr. Ziad Elnasser, MD, Ph.D

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# Course Description:

This course provides medical students with vital microbiology information that will enable them to carry out their duties in an informed, safe, and efficient manner, and protect themselves and their patients from infectious diseases. It is appropriate as an introductory microbiology course, as it contains all of the concepts and topics needed by those students to use as a base for the microbiology of the modular systems that are going to be studied after.

This course will cover a typical undergraduate microbiology topics of special importance to students of the healthcare professions include those dealing with disinfection and sterilization, antibiotics and other antimicrobial agents, epidemiology and public health, healthcare-associated infections and infection control, how infectious diseases are diagnosed , how microbes cause disease, how our bodies protect us from pathogens and infectious diseases , and the major viral, bacterial, fungal, and parasitic diseases of humans.

This course is going to be a three credit hours, two lectures and one laboratory per week. It is going to have two midterm examinations that will cover 60% of the total grade in a combined theoretical as well as practical aspect. The final exam will cover 40% of the course as well.

**Reference Text book used: Burton's Microbiology For the Health Sciences** latest edition, by Paul Engilkirk and Janet Engilkirk.

**Instructors:** Ziad Elnasser , MD, Ph.D. Rakan Alhamad MD, FRCpath, Naser Kaplan, MD, Ph.D

# Course Learning Outcomes

1. Describe the history of the microbial world, pioneers who has contributed to the development of this science, and the development of the germ theory of disease.
2. Discuss the theory of microscopy, units of measurements of microbes, different types of microscopes used in microbiology in order to view the microbial world..
3. Know the cell structure and taxonomy of microbes, nomenclature and the system used for this purpose and the significance of this information as virulent factors and mechanism of action of antibiotics and pathogenesis..
4. Describe the diversity of microbes associated with human diseases, viruses structure, classification, multiplication, pathogenesis, diagnosis and treatment. Eukaryotes (Protozoa, Algae, Fungi) their structure, classification, pathogenesis, diagnosis and treatment. Prokaryotes (Bacteria, morphology, staining methods, growth and media used, and significance in diagnosis of bacterial infectious diseases.
5. Describe The biochemistry of life which include the name of four main categories of biochemical molecules and their uses in microbiology.
6. Discuss Microbial physiology and Genetics in microbes and their uses in explaining their growth, virulence, pathogenesis, evolution, and the role-played in antimicrobial resistance mechanisms.
7. Describe how to Control the growth of the microbial growth in vitro and in vivo, which include all methods used in sterilization and disinfection especially in health care facilities and antibiotics types and their mechanism of action and their uses and abuse in general, methods used in the laboratory for antibiotics susceptibility testing and its importance in clinical practices.
8. Describe the Microbial ecology and Microbial biotechnology, which include the mutual relationship between microbes and its significance. The normal flora role in our health and disease, biotechnology methods used and their role in the advances of medicine in the whole world.
9. Discuss the main concepts of Epidemiology and public health in Microbiology and infectious diseases, all the terminology used, world agencies involved, and the methods of surveillance and reporting used and their significance.

10. Discuss the Healthcare Epidemiology and healthcare associated infections, definitions, types , significance on health care systems and the methods used to control them.
11. List the methods used in diagnosing infectious diseases which include the specimen collection methods used, transport of specimens, methods used in analysis and post analysis methods (reporting).
12. Explain the concepts of Pathogenesis of infectious diseases, which include all the terminology involved in how infectious diseases transmitted and the steps the patients are going through, incubation period, acute, chronic, symptoms, signs, latency and some examples for each. Virulent vectors and their mechanism of tissue damage.
13. Explain the methods our body uses to defend us against infections, first , second , and third line of defense. All the terminology used in immunology, cells and organs, innate and acquired immune defences. vaccines types and mechanism of action. Some clinical immunology like diseases of hypersensitivity, autoimmunity, immune deficiency diseases and clinical immunology tests used to make diagnosis of infectious diseases or autoimmune diseases.
14. Have an overview of infectious diseases, Bacterial, viral, fungal and parasitic. Major anatomical areas and pathogens involved simple introductory information about pathogens involved pathogenesis, diagnosis , treatment and prevention. An introductory approach of modules organisms involved.

# Learning Objectives

## (A) Lectures objectives

<p><b>Introduction to Microbiology</b></p>	<ul style="list-style-type: none"> <li>a. Define microbiology, pathogens, nonpathogens, and opportunistic pathogens.</li> <li>b. Differentiate between acellular microbes and cellular microorganisms and be able to list several examples of each.</li> <li>c. List several reasons why microbes are important (e.g., as a source of antibiotics).</li> <li>d. Explain the relationship between microbes and infectious diseases.</li> <li>e. Differentiate between infectious diseases and microbial intoxications.</li> <li>f. List some of the contributions of Leeuwenhoek, Pasteur, and Koch to microbiology.</li> <li>g. Differentiate between biogenesis and abiogenesis.</li> <li>h. Explain the germ theory of disease.</li> <li>i. Outline Koch's Postulates and cite some circumstances in which they may not apply.</li> <li>j. Discuss two medically related fields of microbiology.</li> </ul>
<p><b>Microscopy in Microbiology</b></p>	<ul style="list-style-type: none"> <li>a. Explain the interrelationships among the following metric system units of length: centimeters, millimeters, micrometers, and nanometers.</li> <li>b. State the metric units used to express the sizes of bacteria, protozoa, and viruses.</li> <li>c. Compare and contrast the various types of microscopes, to include simple microscopes, compound lightmicroscopes, electron microscopes, and atomic force microscopes.</li> </ul>
<p><b>Cell structure and Taxonomy</b></p>	<ul style="list-style-type: none"> <li>a. Explain what is meant by the cell theory .</li> <li>b. State the contributions of Hooke, Schleiden and Schwann, and Virchow to the study of cells.</li> <li>c. Cite one function for each of the following parts of a eukaryotic cell: cell membrane, nucleus, ribosomes, Golgi complex, lysosomes, mitochondria, plastids, cytoskeleton, cell wall, flagella, and cilia.</li> <li>d. Cite a function for each of the following parts of a bacterial cell: cell membrane, chromosome, cell wall, capsule, flagella, pili, and endospores.</li> </ul>

	<ul style="list-style-type: none"> <li>e. Compare and contrast plant, animal, and bacterial cells .</li> <li>f. Define the following terms: genus, specific epithet, and species.</li> <li>g. Describe the Five-Kingdom and Three-Domain Systems of Classification..</li> </ul>
<p><b>Diversity of the microbial world</b></p>	<ul style="list-style-type: none"> <li>a. Describe the characteristics used to classify viruses (e.g., DNA vs. RNA)</li> <li>b. List five specific properties of viruses that distinguish them from bacteria.</li> <li>c. List at least three important viral diseases of humans.</li> <li>d. Discuss differences between viroids and prions, and the diseases they cause .</li> <li>e. List various ways in which bacteria can be classified.</li> <li>f. State the three purposes of fixation.</li> <li>g. Define the terms diplococci, streptococci, staphylococci, tetrad, octad, coccobacilli, diplobacilli, streptobacilli, and pleomorphism.</li> <li>h. Define the terms obligate aerobe, microaerophile, facultative anaerobe, aerotolerant anaerobe, obligate anaerobe, and capnophile.</li> <li>i. State key differences among rickettsias, chlamydias, and mycoplasmas.</li> <li>j. Identify several important bacterial diseases of humans.</li> <li>k. State several ways in which archaea differ from bacteria.</li> </ul>
<p><b>Diversity of the microbial world (continued)</b></p>	<ul style="list-style-type: none"> <li>a. 1 Compare and contrast the differences between algae, protozoa, and fungi (e.g., photosynthetic ability, chitin in cell walls).</li> <li>b. Explain what is meant by a “red tide” (i.e., what causes it) and its medical significance.</li> <li>c. List the four major categories of protozoa and their most important differentiating characteristics (e.g., their mode of locomotion) .</li> <li>d. Define the terms pellicle, cytostome, and stigma.</li> <li>e. List five major infectious diseases of humans that are caused by protozoa and five that are caused by fungi.</li> <li>f. Define and state the importance of phycotoxins and mycotoxins.</li> <li>g. Explain the differences between aerial and vegetative hyphae, septate and aseptate hyphae, and sexual and asexual spores.</li> </ul>

	<p>h. Explain the major difference between a lichen and a slime mold.</p>
<p><b>The biochemistry of life</b></p>	<p>a. Name the four main categories of biochemical molecules discussed in this lecture.</p> <p>b. State the major differences between trioses, tetroses, pentoses, hexoses, and heptoses</p> <p>c. Describe each of the following: monosaccharides, disaccharides, and polysaccharides, and cite two examples of each.</p> <p>d. Compare and contrast a dehydration synthesis reaction and a hydrolysis reaction, and cite an example of each.</p> <p>e. Differentiate between covalent, glycosidic, and peptide bonds.</p> <p>f. Discuss the roles of enzymes in metabolism.</p> <p>g. Define the following terms: apoenzyme, cofactor, coenzyme, holoenzyme, and substrate.</p> <p>h. Cite three important differences between the structures of DNA and RNA.</p> <p>i. State the major differences between DNA nucleotides and RNA nucleotides.</p> <p>j. Define what is meant by “the Central Dogma” .</p> <p>k. Describe the processes of DNA replication, transcription, and translation.</p>
<p><b>Microbial physiology and Genetics</b></p>	<p>a. Define phototroph, chemotroph, autotroph, heterotroph, photoautotroph, chemoheterotroph, endoenzyme, exoenzyme, plasmid, R-factor, “superbug,” mutation, mutant, and mutagen.</p> <p>b. Discuss the relationships among apoenzymes, coenzymes, and holoenzymes.</p> <p>c. Differentiate between catabolism and anabolism.</p> <p>d. Explain the role of adenosine triphosphate (ATP) molecules in metabolism.</p> <p>e. Briefly describe each of the following: biochemical pathways, aerobic respiration, glycolysis, the Krebs cycle, the electron transport chain, oxidation–reduction reactions, and photosynthesis.</p> <p>f. Explain the differences between beneficial, harmful, and silent mutations.</p> <p>g. Briefly describe each of the following ways in which bacteria acquire genetic information: lysogenic conversion, transduction, transformation, and conjugation.</p>

<p><b>Controlling the microbial growth. (in vitro).</b></p>	<ul style="list-style-type: none"> <li>a. List several factors that affect the growth of microorganisms.</li> <li>b. Describe the following types of microorganisms: psychrophilic, mesophilic, thermophilic, halophilic, haloduric, alkaliphilic, acidophilic, and piezophilic.</li> <li>c. List three in vitro sites where microbial growth is encouraged.</li> <li>d. Differentiate among enriched, selective, and differential media, and cite two examples of each.</li> <li>e. Explain the importance of using “aseptic technique” in the microbiology laboratory.</li> <li>f. Describe the three types of incubators that are used in the microbiology laboratory.</li> <li>g. Draw a bacterial growth curve and label its four phases.</li> <li>h. Cite two reasons why bacteria die during the death phase.</li> <li>i. Name three ways in which obligate intracellular pathogens can be cultured in the laboratory.</li> <li>j. List three in vitro sites where microbial growth must be inhibited.</li> <li>k. Differentiate among sterilization, disinfection, and sanitization.</li> <li>l. Differentiate between bactericidal and bacteriostatic agents.</li> <li>m. Explain the processes of pasteurization and lyophilization.</li> <li>n. List several physical methods used to inhibit the growth of microorganisms</li> <li>o. Cite three ways in which disinfectants kill microorganisms.</li> <li>p. Identify several factors that can influence the effectiveness of disinfectants</li> <li>q. Explain briefly why the use of antibiotics in animal feed and household products is controversial.</li> </ul>
<p><b>Control the growth of pathogenic microorganisms in vivo using antimicrobial agents</b></p>	<ul style="list-style-type: none"> <li>a. Identify the characteristics of an ideal antimicrobial agent.</li> <li>b. Compare and contrast chemotherapeutic agents, antimicrobial agents, and antibiotics as to their intended purpose.</li> <li>c. State the five most common mechanisms of action of antimicrobial agents.</li> <li>d. Differentiate between bactericidal and bacteriostatic agents.</li> <li>e. State the difference between narrow-spectrum and broad-spectrum antimicrobial agents.</li> <li>f. Identify the four most common mechanisms by which bacteria become resistant to antimicrobial agents</li> <li>g. State what the initials “MRSA” and “MRSE” stand for .</li> <li>h. Define the following terms: <math>\beta</math>-lactam ring, <math>\beta</math>-lactam antibiotics, and <math>\beta</math>-lactamase.</li> <li>i. Name two major groups of bacterial enzymes that destroy the <math>\beta</math>-lactam ring.</li> <li>j. State six actions that clinicians and/or patients can take to help in the war against drug resistance.</li> <li>k. Explain what is meant by empiric therapy .</li> </ul>

	<ul style="list-style-type: none"> <li>l. List six factors that a clinician would take into consideration before prescribing an antimicrobial agent for a particular patient.</li> <li>m. State three undesirable effects of antimicrobial agents.</li> <li>n. Explain what is meant by a “superinfection,” and cite three diseases that can result from superinfections.</li> <li>o. Explain the difference between synergism and antagonism with regard to antimicrobial agents.</li> </ul>
<p><b>Microbial ecology and Microbial biotechnology</b></p>	<ul style="list-style-type: none"> <li>a. Define ecology, human ecology, and microbial ecology.</li> <li>b. List three categories of symbiotic relationships.</li> <li>c. Differentiate between mutualism and commensalism and give an example of each.</li> <li>d. Cite an example of a parasitic relationship.</li> <li>e. Discuss the beneficial and harmful roles of the indigenous microbiota of the human body.</li> <li>f. Describe biofilms and their impact on human health .</li> <li>g. Outline the nitrogen cycle; include the meanings of the terms nitrogen fixation, nitrification, denitrification, and ammonification in the description .</li> <li>h. Name 10 foods that require microbial activity for their production.</li> <li>i. Define biotechnology and cite four examples of how microbes are used in industry.</li> <li>j. Define bioremediation and cite an example.</li> </ul>
<p><b>Epidemiology and public health</b></p>	<ul style="list-style-type: none"> <li>a. Define epidemiology.</li> <li>b. Differentiate between infectious, communicable, and contagious diseases; cite an example of each.</li> <li>c. Differentiate between the incidence of a disease and the prevalence of a disease.</li> <li>d. Distinguish between sporadic, endemic, nonendemic, epidemic, and pandemic diseases.</li> <li>e. Name three diseases that are currently considered to be pandemics.</li> <li>f. List, in the proper order, the six components of the chain of infection .</li> <li>g. Identify three examples of living reservoirs and three examples of nonliving reservoirs.</li> <li>h. List five modes of infectious disease transmission.</li> <li>i. List four examples of potential biological warfare (BW) or bioterrorism agents.</li> <li>j. Outline the steps involved in water treatment.</li> <li>k. Explain what is meant by a coliform count and state its importance.</li> </ul>

<p><b>Healthcare Epidemiology and healthcare associated infections</b></p>	<ol style="list-style-type: none"> <li>a. Differentiate between healthcare-associated, community-acquired, and iatrogenic infections.</li> <li>b. List the seven pathogens that most commonly cause healthcare-associated infections.</li> <li>c. State the four most common types of healthcare associated infections.</li> <li>d. List six types of patients who are especially vulnerable to healthcare-associated infections.</li> <li>e. State the three major contributing factors in healthcare-associated infections.</li> <li>f. Differentiate between medical and surgical asepsis.</li> <li>g. State the most important and effective way to reduce the number of healthcare-associated infections.</li> <li>h. Differentiate between Standard Precautions and Transmission-Based Precautions, and state the three types of Transmission-Based Precautions.</li> <li>i. Describe the types of patients placed in Protective Environments.</li> <li>j. Cite three important considerations in the handling of each of the following in healthcare settings: food, eating utensils, fomites, and sharps.</li> <li>k. List six responsibilities of an Infection Control Committee.</li> <li>l. Explain three ways in which the Clinical Microbiology Laboratory participates in infection control.</li> </ol>
<p><b>Diagnosing infectious diseases</b></p>	<ol style="list-style-type: none"> <li>a. Discuss the role of healthcare professionals in the collection and transport of clinical specimens.</li> <li>b. List the types of clinical specimens that are submitted to the Clinical Microbiology Laboratory for the diagnosis of infectious diseases.</li> <li>c. Discuss general precautions that must be observed during the collection and handling of clinical specimens.</li> <li>d. Describe the proper procedures for obtaining blood, urine, cerebrospinal fluid (CSF), sputum, throat swabs, wound specimens, GC cultures, and fecal specimens for submission to the Clinical Microbiology Laboratory.</li> <li>e. State the information that must be included on specimen labels and laboratory test requisitions.</li> <li>f. Outline the organization of the Pathology Department and the Clinical Microbiology Laboratory.</li> <li>g. Compare and contrast the anatomical and clinical pathology divisions of the Pathology Department.</li> <li>h. Identify the various types of personnel that work in anatomical and clinical pathology.</li> </ol>
<p><b>Pathogenesis of infectious diseases</b></p>	<ol style="list-style-type: none"> <li>a. Cite four reasons why an individual might not develop an infectious disease after exposure to a pathogen.</li> <li>b. Discuss the four periods or phases in the course of an infectious disease.</li> <li>c. Differentiate between localized and systemic infections.</li> </ol>

	<ul style="list-style-type: none"> <li>d. Explain how acute diseases differ from subacute and chronic diseases.</li> <li>e. Differentiate between “symptoms” of a disease and “signs” of a disease and cite several examples of each.</li> <li>f. Cite several examples of latent infections.</li> <li>g. Differentiate between primary and secondary infections.</li> <li>h. List six steps in the pathogenesis of an infectious disease.</li> <li>i. Define virulence and virulence factors.</li> <li>j. List three bacterial structures that serve as virulence factors.</li> <li>k. List six bacterial exoenzymes that serve as virulence factors.</li> <li>l. Differentiate between endotoxins and exotoxins.</li> <li>m. List six bacterial exotoxins and the diseases they cause.</li> <li>n. Describe three mechanisms by which pathogens escape the immune response.</li> </ul>
<p><b>Nonspecific host defense mechanisms</b></p>	<ul style="list-style-type: none"> <li>a. Define the following terms: host defense mechanisms, antibody, antigen, lysozyme, microbial antagonism, colicin, bacteriocins, superinfection, pyrogen, interferon, complement cascade, complement, opsonization, inflammation, vasodilation, phagocytosis, and chemotaxis.</li> <li>b. Briefly describe the three lines of defense used by the body to combat pathogens and give one example of each.</li> <li>c. Explain what is meant by “nonspecific host defense mechanisms” and how they differ from “specific host defense mechanisms” .</li> <li>d. Identify three ways by which the digestive system is protected from pathogens.</li> <li>e. Describe how interferons function as host defense mechanisms.</li> <li>f. Name three cellular and chemical responses to microbial invasion.</li> <li>g. Describe the major benefits of complement activation.</li> <li>h. List the four main signs and symptoms associated with inflammation.</li> <li>i. Discuss the four primary purposes of the inflammatory response.</li> <li>j. Describe the four steps in phagocytosis.</li> <li>k. Identify the three major categories of leukocytes and the three categories of granulocytes.</li> <li>l. State four ways in which pathogens escape destruction by phagocytes.</li> <li>m. Categorize the disorders and conditions that affect the body’s nonspecific host mechanisms.</li> </ul>

<p><b>Specific host defense mechanisms : An introduction to Immunology</b></p>	<ol style="list-style-type: none"> <li>a. Define the following terms: immunology, immunity, antigenic determinant, immunoglobulins, primary response, secondary response, agammaglobulinemia, hypogammaglobulinemia, T cell, B cell, plasma cell, and immunosuppression</li> <li>b. Differentiate between humoral immunity and cell mediated immunity.</li> <li>c. Distinguish between active acquired immunity and passive acquired immunity.</li> <li>d. Differentiate between natural active acquired immunity and artificial active acquired immunity and cite an example of each.</li> <li>e. Distinguish between natural passive acquired immunity and artificial passive acquired immunity and cite an example of each.</li> <li>f. Outline the steps involved in the processing of T-independent antigens and T-dependent antigens.</li> <li>g. Identify the two primary functions of the immune system.</li> <li>h. Construct a diagram of a monomeric antibody molecule.</li> <li>i. Identify and describe the five immunoglobulin classes (isotypes).</li> <li>j. List the types of cells that are killed by natural killer (NK) cells.</li> <li>k. Name the four types of hypersensitivity reactions.</li> <li>l. Outline the steps involved in allergic reactions, starting with the initial sensitization to an allergen and ending with the typical symptoms of an allergic reaction.</li> <li>m. Cite six examples of allergens.</li> <li>n. List five possible explanations for a positive PPD skin test.</li> </ol>
<p><b>Overview of infectious diseases</b></p>	<ol style="list-style-type: none"> <li>a. Define the terms and abbreviations introduced in this lecture.</li> <li>b. Categorize various infectious diseases by body system (e.g., cystitis is an infection of the urinary bladder, which is part of the genitourinary (GU system; myelitis is an infection of the brain and spinal cord).</li> </ol>
<p><b>Viral infections of medical importance</b></p>	<ol style="list-style-type: none"> <li>a. Correlate various viral diseases with body systems (e.g., rhinoviruses with the respiratory system).</li> <li>b. Correlate a particular viral disease with its major characteristics, etiologic agent, reservoir(s), mode(s) of transmission, and diagnostic laboratory procedures.</li> <li>c. Name several nationally notifiable viral diseases.</li> <li>d. Briefly describe how viruses cause disease.</li> <li>e. Describe Koplik spots and state the disease with which they are associated.</li> <li>f. Characterize the various hepatitis viruses as being either DNA or RNA viruses.</li> <li>g. List several viral diseases that are sexually transmitted.</li> </ol>

<p><b>Bacterial infections of medical importance</b></p>	<ul style="list-style-type: none"> <li>a. Name at least three nationally notifiable bacterial diseases.</li> <li>b. Correlate a particular bacterial disease with its major signs and symptoms, etiologic agent, reservoir(s), mode(s) of transmission, and diagnostic laboratory procedures.</li> <li>c. Given a particular body site (e.g., the urinary tract) state at least one example of a bacterial disease at that site.</li> <li>d. Differentiate between gangrene and gas gangrene.</li> <li>e. Correlate a given bacterial sexually transmitted disease (STD) with its etiologic agent.</li> <li>f. Name at least three rickettsial or ehrlichial infections of the cardiovascular system.</li> <li>g. Name at least three diseases caused by anaerobic bacteria.</li> <li>h. Describe a biofilm, and name at least two human diseases thought to be associated with biofilms.</li> <li>i. State, in general, how bacterial infections are treated.</li> </ul>
<p><b>Fungal infections of medical importance</b></p>	<ul style="list-style-type: none"> <li>a. Define the following terms: mycosis, dimorphic, cutaneous, systemic.</li> <li>b. Categorize various fungal diseases by body system (e.g., respiratory system, circulatory system).</li> <li>c. Correlate a particular fungal disease with its major characteristics, etiologic agent, reservoir(s), mode(s) of transmission, and diagnostic laboratory procedures.</li> <li>d. Briefly explain how fungi cause disease.</li> <li>e. Classify a given fungal infection as being a superficial, cutaneous, subcutaneous, or systemic mycosis.</li> <li>f. State several diseases caused by dimorphic fungi.</li> </ul>
<p><b>Parasitic infections of medical importance</b></p>	<ul style="list-style-type: none"> <li>a. Differentiate between the following: ectoparasites versus endoparasites; definitive hosts versus intermediate hosts; facultative parasites versus obligate parasites; and mechanical vectors versus biologic vectors.</li> <li>b. Classify a particular parasitic infection as a protozoal or helminth disease.</li> <li>c. Categorize various parasitic infections by body system (e.g., respiratory system, gastrointestinal tract, circulatory system).</li> <li>d. Correlate a particular parasitic infection (e.g., giardiasis) with its major characteristics, causative agent, reservoir(s), mode(s)</li> </ul>

## (B) Labs objectives

Title	Objectives
<b>Laboratory Safety</b>	<ul style="list-style-type: none"><li>a. Know all the different laboratory equipment and devices that are going to be used by the students in the general microbiology course.</li><li>b. Know all the general protective measures used in general in handling infectious agents in the animate and inanimate environment.</li><li>c. Know all the specific safety procedures done in case of fire.</li><li>d. Know all the specific safety procedures done when we have bacterial spill.</li><li>e. Know all the specific safety procedures done when we have a wound injury from any sharps.</li><li>f. Know the safety procedures done in the laboratory regarding infectious agents waste disposal.</li><li>g. Know the safety procedures regarding hand washing and its significance.</li></ul>
<b>Microscopy in Microbiology</b>	<ul style="list-style-type: none"><li>a. Know the theory of microscopy in general and all the terms used in this regard (Resolving power and magnification, field magnification, units of measurements in microscopy)</li><li>b. Know the different types of microscopes used in Microbiology in general and the theory of each.</li><li>c. Know the different parts of the bright field compound microscope and the function of each part.</li><li>d. Know why we use oil when we use the oil immersion lens.</li><li>e. Know how to handle and use the bright field compound microscope, and all the safety procedure used in the laboratory in this regard.</li><li>f. Use the bright field microscope to view gram-positive bacteria, gram-negative bacteria, spore former bacteria, fungi, and protozoa.</li></ul>
<b>Stains used in Microbiology</b>	<ul style="list-style-type: none"><li>a. Know why we stain organisms in bright field microscopy.</li><li>b. Contrast the cell wall structure in bacteria, fungi, and protozoa.</li></ul>

	<ul style="list-style-type: none"> <li>c. Know the different types of stains used in microbiology and the principle of each.</li> <li>d. Know all the reagents used in simple staining, Gram staining, Acid Fast staining, and special stains (Spore staining, and negative staining).</li> <li>e. Do a simple stain, gram stain, AFS, and negative staining in groups.</li> <li>f. Know why some gram-positive bacteria could stain as gram negative.</li> </ul>
<p><b>Media preparation</b></p>	<ul style="list-style-type: none"> <li>a. Know the theory and history behind the growth of bacteria in vitro vs in vivo growth.</li> <li>b. Know and contrast between, broth media growth, and solid media growth.</li> <li>c. State the differences between Nutrient Agar, Enriched agar, Differential agar, Selective differential agar, Selective agar and specific example for each.</li> <li>d. Know all the specific content of each media and its function.</li> <li>e. Know the type of specimen used to grow bacteria on each and specific bacterial growth on each medium.</li> <li>f. Know and see the thioglycolate medium, and what do we use it for, see specific demos.</li> <li>g. See demos of live different types of laboratory media and bacterial growth on each.</li> </ul>
<p><b>Bacterial growth control and Hand Hygiene</b></p>	<ul style="list-style-type: none"> <li>a. Know how we control the growth of bacteria in vitro and the principles of infection control.</li> <li>b. Do in groups the growth of bacteria from the inanimate objects (tables, chairs, floor, walls , windows...etc).</li> <li>c. Do in groups the growth of bacteria from the room air environment.</li> <li>d. Perform an index finger culture before and after hand washing with soap and water, and after the use of alcohol base hand rub.</li> <li>e. Perform and master the standard technique of hands washing as the single important technique used in hospitals for infection control.</li> <li>f. Contrast the use of some disinfectants and their significance in infection control</li> </ul>

	(Phenolic compounds, Hypochlorite solution, and formaldehyde).
<b>Bacterial identification procedures (Two sessions)</b>	<ul style="list-style-type: none"> <li>a. Know how specimens are collected properly (Throat, wound, urine, sputum, blood, CSF, skin scaping....etc. and do throat</li> <li>b. Know and see a demo of how we identify gram positive cocci in the laboratory, gram stain, MSA, catalase test, coagulase test, bacitracin and Optochin susceptibility, media used.</li> <li>c. Know and see a demo of how we identify gram negative bacteria , gram stain, oxidase test, KIA test, biochemical used for the identification of members of the enterobacteriaceae family (nitrate, citrate, Indole, MRVP, different sugar fermentation tests), and the media used.</li> <li>d. Know the significance of quality control program done in the clinical microbiology laboratory, and see a demo of some things done.</li> <li>e. See a demo of some of the identified bacteria on the culture media and the biochemicals used for their identification.</li> <li>f. See the final stage of the process (reporting) and its significance.</li> </ul>
<b>Antibiotics susceptibility testing</b>	<ul style="list-style-type: none"> <li>a. Know the theory behind AST, definition of terms (MIC, MBC...etc), how we measure the MIC in the laboratory.</li> <li>b. See a demo of the Kirby – Bauer disk diffusion testing we perform in the clinical laboratory.</li> </ul>
<b>Fungal and parasitic laboratory identification</b>	<ul style="list-style-type: none"> <li>a. Know the common yeast and mold infections in humans.</li> <li>b. See how we culture fungi in the clinical microbiology laboratory and how we differentiate yeasts from molds.</li> <li>c. See the method of identification of Candida albicans in the laboratory and demonstration of the germ tube testing.</li> <li>d. Do a tease preparation from a mold and identify some that are associated with human infections.</li> <li>e. See some of the pathogenic protozoa (Entamoeba histolytica, Giardia lamblia, trypanosome and Leishmania spp,</li> </ul>

	Plasmodium and some other helminths in the laboratory.
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# Course Assessment

<b>Assessment</b>		
<b>Assessment Type</b>	<b>Expected Due Date</b>	<b>Weight</b>
First Mid term Exam	6-8 weeks	30%
Second Exam	12-14 weeks	30%
<b>Final Exam</b>		<b>40%</b>
<b>Total</b>		<b>100%</b>

# Students Learning Outcomes

<b>Student Learning Outcomes(SLOs)</b> <b>(4-8 Maximum)</b> Upon successful completion of this course, students should be able to:			
SLOs	Related ILO(s)* (numbers only)	Evaluation Criteria (MCQ, OSCE, Homework...)	
		Type of Criteria (MCQ, OSCE, Homework...)	Weight (%)
Describe the basic concepts of microbes in relationship to structure, function, classification, genetics and ecology.	1	MCQ	30
Describe all types of sterilization and disinfection concepts used in a hospital set up.	2	MCQ	10
Know all types of antibiotics, their mechanism of action, principle of use and prevention from abuse.	2	MCQ	15
Describe the concepts of epidemiology and Health Associated Infection in hospitals, types, causes, and control	2	MCQ	15
Describe all concepts of defense in our body, its clinical role, and its laboratory role.	3	MCQ	25
Demonstrate general knowledge about infectious disease caused by, bacteria, viruses, fungi and parasites	1	MCQ	5
			<b>100</b>

## Intended Learning Outcomes (ILOs)

- 1) Demonstrate a sufficient understanding of the structural and functional role of microbes in disease and environment and all concepts of sterilization and disinfection as well as in antibiotics types, mechanism of action, use and prevention of abuse.
- 2) Understand the role of microbes in causing diseases, and how to diagnose, treat and prevent these infections.
- 3) Apply their knowledge of microbes terminology and nomenclature in order to describe the infectious diseases, make diagnosis and treatment.
- 4) Understand the concepts of health related infections in hospitals, health care epidemiology, especially hand hygiene policies.
- 5) Understand human defenses and all the clinical applications related to , like vaccinations, transplantation, autoimmune diseases and allergies. .
- 6) Have a general knowledge of bacterial, viral, fungal and parasitic diseases as an introduction to the system modules that are going to be taken afterwards.
- 7) Develop some laboratory skills in microbiology so they will understand how infectious diseases are diagnosed in the clinical microbiology and immunology laboratories.
- 8) Apply safe practices related to infection control in hospitals and the proper use of antibiotics.