Semester – V

19MBU501A MANAGEMENT OF HUMAN MICROBIAL DISEASES (4H – 4C)

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

COURSE OBJECTIVES

- To provide a strong base in the fundamentals of pathogens.
- To learn techniques and methods used in the cultivation and isolation of pathogens.
- To obtain with the knowledge about the habitat and characteristics of pathogens in detail.

COURSE OUTCOME

Involves the identification, classification, and characterization of various pathogens.

Unit I

Infectious and non-infectious diseases, microbial and non-microbial diseases, Deficiency diseases, occupational diseases, Incubation period, mortality rate, nosocomial infections

Unit II

Respiratory microbial diseases, gastrointestinal microbial diseases, Nervous system diseases, skin diseases, eye diseases, urinary tract diseases, Sexually transmitted diseases: Types, route of infection, clinical systems and general prevention methods, study of recent outbreaks of human diseases (SARS/ Swine flu/Ebola) – causes, spread and control, Mosquito borne disease – Types and prevention.

Unit III

Treatment using antibiotics: beta lactam antibiotics (penicillin, cephalosporins), quinolones, polypeptides and aminoglycosides**.** Anti-fungal and anti-parasitic agents.Judicious use of antibiotics, importance of completing antibiotic regimen, Concept of DOTS, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains. Treatment using antiviral agents: Amantadine, Acyclovir, Azidothymidine. Concept of HAART.

Unit IV

General preventive measures, Transmission and prevention of microbial diseases.Importance of personal hygiene, environmental sanitation and methods to prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors.

Unit V

Importance, types, Vaccine preparation, synthetic or recombinant vaccines.vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in the Indian context.

SUGGESTED READINGS

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier.
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.
5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.

UNIT I

Duration (h)	Topic	Reference
01	Infectious and non-infectious diseases	W1
01	Microbial diseases	T1; 913-947
01	Non-microbial diseases	
01	Deficiency diseases	W2
01	Occupational diseases	W3
01	Incubation period	R1 and R2
01	Mortality rate	W4
01	Nosocomial infections	R3
01	Unit revision and possible questions.	
Total hours: 9 h		

W1; http://www.euro.who.int/__data/assets/pdf_file/0013/102316/e79822.pdf

T1; Willey JM, Sherwood LM, and Woolverton CJ. (2008) Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

W2; https://www.britannica.com/science/human-disease/Diseases-of-nutrition#ref525049

W3; https://www.britannica.com/science/occupational-disease

R1; Sharara, A. I. (1997). "Chronic hepatitis C". Southern Medical Journal. 90 (9): 872–7. doi:10.1097/00007611-199709000-00002. PMID 9305294.

R2; Miranda; Johansson, Michael A. (Nov 30, 2012). "The Incubation Periods of Dengue Viruses". 7 (11): e50972. doi:10.1371/journal.pone.0050972. PMC 3511440 . PMID 23226436.

W4; https://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson3/section3.html

R3; Nosocomial infections: Epidemiology, prevention, control and surveillance, Asian Pacific Journal of Tropical Biomedicine Volume 7(5), 2017, 478-482, https://doi.org/10.1016/j.apjtb.2017.01.019

UNIT II

Duration (h)	Topic	Reference
01	Respiratory microbial diseases	T2: C 93
01	Gastrointestinal microbial diseases	T2: C 95
01	Nervous system diseases	T2: C 96
01	Skin diseases	T2: C 98
01	Eye diseases	
01	Urinary tract diseases	T2: C 97
01	Sexually transmitted diseases	T3: II, III, IV, V
01	Study of recent outbreaks of human diseases -SARS	W5
01	Study of recent outbreaks of human diseases- Swine flu	W6
01	Study of recent outbreaks of human diseases-Ebola	W7
02	Mosquito borne disease – Types and prevention	W8
01	Unit revision and possible questions.	
Total hours: 13 h		

T2: C93: Dasaraju PV, Liu C. Infections of the Respiratory System. In: Baron S, editor. Medical Microbiology. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 93. Available from: https://www.ncbi.nlm.nih.gov/books/NBK8142/

T2: C95: Gorbach SL. Microbiology of the Gastrointestinal Tract. In: Baron S, editor. Medical Microbiology. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 95. Available from: https://www.ncbi.nlm.nih.gov/books/NBK7670/

T2: C96: Johnson RT. Microbiology of the Nervous System. In: Baron S, editor. Medical Microbiology. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 96. Available from: https://www.ncbi.nlm.nih.gov/books/NBK8534/

T2: C98: Aly R. Microbial Infections of Skin, Nails and Eyes. In: Baron S, editor. Medical Microbiology. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 98. Available from: https://www.ncbi.nlm.nih.gov/books/NBK8301/

T2: C97: Ronald AR, Alfa MJ. Microbiology of the Genitourinary System. In: Baron S, editor. Medical Microbiology. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 97.Available from: https://www.ncbi.nlm.nih.gov/books/NBK8136/

T3: Part: II, III, IV, V: Gerd Gross, Stephen K. Tyring. Sexually Transmitted Infections and Sexually Transmitted Diseases. 2011, Springer

W5; http://www.who.int/ith/diseases/sars/en/

W6; https://www.cdc.gov/flu/swineflu/h3n2v-situation.htm

W6; http://www.who.int/ebola/en/

W8; http://www.who.int/neglected_diseases/vector_ecology/mosquito-borne-diseases/en/

UNIT III

Duration (h)	Topic	Reference
01	Treatment using antibiotics: beta lactam antibiotics (penicillin, cephalosporins), quinolones	T4; 71 – 85 90- 98 T4; 119 - 125
01	Treatment using antibiotics: polypeptides and aminoglycosides	T4; 301 - 329 T4; 229 - 235
01	Anti-fungal agents	T5: 177 - 181
01	Anti-parasitic agents	T6: 154 - 159
01	Judicious use of antibiotics	W9 and W10
01	Importance of completing antibiotic regimen	
01	Concept of DOTS	R3
01	Emergence of antibiotic resistance	R4
01	Current issues of MDR/XDR microbial strains	
01	Treatment using antiviral agents: Amantadine, Acyclovir, Azidothymidine	T7: 137-139 T8: 510-517 550-555
01	Concept of HAART	R5
01	Unit revision and possible questions	
Total hours: 12 h		

T4: Thomas J. Dougherty, Michael J. Pucci (2012) Antibiotic discovery and development. Springer, UK.

T5: Amit Basak, Ranadhir Chakraborty, Santi M. Mandal (2016) Recent Trends in Antifungal Agents and Antifungal Therapy. Springer, India.

T6: Patrick R. Murray (2018) Basic Medical Microbiology. Elsevier

T7: P E. Came, L. A. Caliguiri (2005) Chemotherapy of Viral Infections. Springer, UK.

T8: Eric M. Scholar, Eric Michael Scholar, William B. Pratt (2000) The Antimicrobial Drugs. Oxford University Press, New York.

R3: Davies PD, 2003. The role of DOTS in tuberculosis treatment and control. American Journal of Respiratory Medicine, 2(3):203-9.

R4: Jyoti Tanwar, Shrayanee Das, Zeeshan Fatima, and Saif Hameed, 2014. Multidrug Resistance: An Emerging Crisis. Interdisciplinary Perspectives on Infectious Diseases, Article ID 541340, 7 pages

R5: Eric J. Arts and Daria J. Hazuda, 2012. HIV-1 Antiretroviral Drug Therapy. Cold Spring Harbor Perspectives in Medicine, 2(4): a007161.

W9: https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm092810.html

W10: https://www.fda.gov/animalveterinary/safetyhealth/antimicrobialresistance/judicioususeofantimicrobials/

UNIT IV

Duration (h)	Topic	Reference
01	General preventive measures	W11 and R6
01	Transmission and prevention of microbial diseases	
01	Importance of personal hygiene	R7
01	Environmental sanitation	
01	Methods to prevent the spread of infectious agents transmitted by direct contact, food	W12
01	Methods to prevent the spread of infectious agents transmitted by water and insect vectors	
01	Unit revision and possible questions	
Total hours: 7 h		

W11; https://courses.lumenlearning.com/microbiology/chapter/modes-of-disease-transmission/

R6; Drexler M; Institute of Medicine (US). What You Need to Know About Infectious Disease. Washington (DC): National Academies Press (US); 2010. IV, Prevention and Treatment. Available from: https://www.ncbi.nlm.nih.gov/books/NBK209704/

R7; Ganesh S Kumar, Sitanshu Sekhar Kar, and Animesh Jain (2011) Health and environmental sanitation in India: Issues for prioritizing control strategies, Indian J Occup Environ Med. 15(3): 93–96. doi: 10.4103/0019-5278.93196

W12; http://www.open.edu/openlearncreate/mod/oucontent/view.php?id=84&printable=1

UNIT V

Duration (h)	Topic	Reference
01	Importance, types of vaccines	T9; 40-50
01	Synthetic or recombinant vaccines	
01	Vaccine preparation	T10; 78-84
01	Vaccines available against microbial diseases	W13
01	Vaccination schedule (compulsory and preventive) in the Indian context	R8
01	Revision of all units and possible questions	
01	Last five year old question paper discussion	
Total hours: 7 h		

T9; Carol Hand (2014) Vaccines. ABDO Publishing company, Minnepolis

T10; Barry R. Bloom, Paul-Henri Lambert (2016) The Vaccine Book, Elsevier

W13; http://www.who.int/immunization/diseases/en/

R8; Lahariya, C. (2014). A brief history of vaccines & vaccination in India. The Indian Journal of Medical Research, 139(4), 491–511.

Unit 1

Syllabus

Infectious and non-infectious diseases, microbial and non-microbial diseases, Deficiency diseases, occupational diseases, Incubation period, mortality rate, nosocomial infections

Infectious and Microbial diseases: Infection is the invasion of an organism's body tissues by disease-causing agents, their multiplication, and the reaction of host tissues to the infectious agents and the toxins they produce. Infectious disease, also known as transmissible disease or communicable disease is illness resulting from an infection.

Hosts can fight infections using their immune system. Mammalian hosts react to infections with an innate response, often involving inflammation, followed by an adaptive response.

Causes: Infections are caused by pathogenic organisms including viruses, bacteria, viroids, prions, nematodes, arthropods, fungi, macroparasites and other helminths.

Route of infection: Infectious agents can enter the body through

- Skin contact or injuries
- Inhalation of airborne germs
- Ingestion of contaminated food or water
- Tick or mosquito bites
- Sexual contact

Symptoms: The symptom of an infection depends on the type of disease. Some signs of infection affect the whole body generally, such as fatigue, loss of appetite, weight loss, fevers, night sweats, chills, aches and pains. Others are specific to individual body parts, such as skin rashes, coughing, or a runny nose. In certain cases, infectious diseases may be asymptomatic for much or even their entire course in a given host. In the latter case, the disease may only be defined as a "disease" (which by definition means an illness) in hosts who secondarily become ill after contact with an asymptomatic carrier.

Transmission:

(a) Direct contact: An easy way to catch most infectious diseases is by coming in contact with a person or animal who has the infection. Three ways infectious diseases can be spread through direct contact are:

- Person to person- A common way for infectious diseases to spread is through the direct transfer of bacteria, viruses or other germs from one person to another. This can occur when an individual with the bacterium or virus touches, kisses, or coughs or sneezes on someone who isn't infected. These germs can also spread through the exchange of body fluids from sexual contact. The person who passes the germ may have no symptoms of the disease, but may simply be a carrier.
- Animal to person (Zoonoses)- Being bitten or scratched by an infected animal even a pet can cause an infection and, in extreme circumstances, can be fatal. Handling animal waste can be hazardous, too.
  Example: Cats - Toxoplasmosis - *Toxoplasma gondii***;** Dogs - Rabies - *Lyssaviruses***;** Cats (cat scratch disease) - *Bartonella heneslae and Bartonella Quintana* etc,.
- Mother to unborn child (Vertically transmitted disease)- A pregnant woman may pass infectious agents that cause infectious diseases to her unborn baby. Some infectious agents can pass through the placenta. Infectious agents in the birth canal can be transmitted to the baby during birth.
  Example: HIV – AIDS; *Trypanosoma cruzi* – Chagos disease, HPV, *Candida albicans, N. gonorrhoeae, Chlamydia trachomatis*.

(b) Indirect contact: Disease-causing organisms also can be passed by indirect contact. Many Infectious agents can linger on an inanimate object, such as a tabletop, doorknob or faucet handle.
Insect bites: Some infectious agents rely on insect carriers such as mosquitoes, fleas, lice or ticks to move from host to host. These carriers are known as vectors. Example: (i) Mosquitoes can carry the malaria parasite or West Nile virus, (ii) Deer ticks may carry *Borrelia* type that cause Lyme disease
Food contamination: Another way disease-causing infectious agents can reach the host is through contaminated food and water. This mechanism of transmission allows Infectious agents to be spread to many people through a single source. Example: *E. coli* present in or on certain foods such as undercooked hamburger or unpasteurized fruit juice.

Complications: Most infectious diseases have only minor complications. But some infections can become life-threatening. A few types of infections have been linked to a long-term increased risk of cancer:

- *Human papillomavirus* is linked to cervical cancer
- *Helicobacter pylori* is linked to stomach cancer and peptic ulcers
- *Hepatitis B* and *C* have been linked to liver cancer

Treatment: Specific medications used to treat infections include antibiotics, antivirals, antifungals, antiprotozoals, and antihelminthics.

Prevention: Good personal hygiene is one of the most effective ways to avoid the infection; Hand washing is an effective way of preventing the spread of infectious microorganisms from one person to another; Vaccination is one of the most effective ways to prevent infections

Non-microbial or non-infectious diseases: Diseases that are not contagious are called non-microbial or non-infectious diseases because they can't be spread from one person to another. So there's no vector for them to move from one host to another, no virus, no bacteria, no pathogen. Instead, these diseases are caused by other factors, such as genetics, environment, and lifestyle behaviours. Some can be prevented, while others are completely out of your control.

Many non-microbial diseases are linked to our genes, such as autoimmune diseases. These are diseases that cause the body to attack itself instead of simply fighting off foreign intruders. examples of autoimmune diseases: rheumatoid arthritis, multiple sclerosis, lupus, celiac disease etc, and other examples of non-microbial and non-infectious diseases are allergies, cancer, diabetes, irritable bowel syndrome, narcolepsy, cataracts, osteoporosis, chronic kidney disease, alzheimer's disease, cardiovascular disease (cvd) etc,.

Rheumatoid arthritis: Rheumatoid arthritis (RA) is an autoimmune disease that can cause joint pain, joint swelling, joint stiffness, loss of joint function and damage throughout the body. The joint damage that RA causes usually happens on both sides of your body. So if a joint is affected in one of the arms or legs, the same joint in the other arm or leg will probably be affected, too.

Multiple sclerosis: Multiple sclerosis (MS) is a potentially disabling disease of the brain and spinal cord (central nervous system). In MS, the immune system attacks the protective sheath (myelin) that covers nerve fibers and causes communication problems between brain and the rest of the body. Multiple sclerosis signs and symptoms may differ greatly from person to person and over the course of the disease depending on the location of affected nerve fibers. They may include: Numbness or weakness in one or more limbs that typically occurs on one side of the body at a time, or the legs and trunk; Partial or complete loss of vision, often with pain during eye movement; Prolonged double vision; Tingling or pain in parts of the body; Electric-shock sensations that occur with certain neck movements, especially bending the neck forward; Tremor, lack of coordination or unsteady gait; Slurred speech; Fatigue; Dizziness; Problems with bowel and bladder function

Lupus: Lupus is a systemic autoimmune disease that occurs when the body's immune system attacks own tissues and organs. Inflammation caused by lupus can affect many different body systems including your joints, skin, kidneys, blood cells, brain, heart and lungs. The most distinctive sign of lupus are facial rash that resembles the wings of a butterfly unfolding across both cheeks and other symptoms are fatigue, skin lesions that appear or worsen with sun exposure (photosensitivity), fingers and toes that turn white or blue when exposed to cold or during stressful periods, shortness of breath, chest pain, dry eyes, headaches, confusion and memory loss, joint pain, stiffness and swelling.

Celiac Disease: Celiac disease is a condition where the intestine suffers a bad reaction to gluten-containing products (Gluten is a protein found in rye, wheat, barley, and any product that is made with these grains such as bread, bagels, muffins, cakes, crusts and cookies) when they are consumed. The most common signs for adults are diarrhea, fatigue, weight loss, bloating and gas, abdominal pain, nausea, constipation, and vomiting. In children, typical signs and symptoms of celiac disease include: vomiting; chronic diarrhea; swollen belly; failure to thrive; poor appetite; muscle wasting; diarrhea; constipation; weight loss; irritability; short stature; delayed puberty; Neurological symptoms, including attention-deficit/hyperactivity disorder (ADHD), learning disabilities, headaches, lack of muscle coordination and seizures.

Cancer: Cancer refers to any one of a large number of diseases characterized by the development of abnormal cells that divide uncontrollably and have the ability to infiltrate and destroy normal body tissue. Cancer often has the ability to spread throughout your body. Cancer is caused by changes (mutations) to the DNA within cells. It is also non-infectious. Signs and symptoms caused by cancer will vary depending on what part of the body is affected. Some general signs and symptoms associated with, but not specific to, cancer, include: fatigue; lump or area of thickening that can be felt under the skin; weight changes, including; unintended loss or gain; skin changes, such as yellowing, darkening or redness of the skin, sores that won't heal, or changes to existing moles; changes in bowel or bladder habits; persistent cough or trouble breathing; difficulty swallowing; hoarseness; persistent indigestion or discomfort after eating; persistent, unexplained muscle or joint pain; persistent, unexplained fevers or night sweats; unexplained bleeding or bruising.

Diabetes: Diabetes is a group of diseases in which the body doesn't produce enough or any insulin, doesn't properly use the insulin that is produced, or exhibits a combination of both. Chronic diabetes conditions include type 1 diabetes and type 2 diabetes. Potentially reversible diabetes conditions include prediabetes (blood sugar levels are higher than normal, but not high enough to be classified as diabetes) and gestational diabetes, which occurs during pregnancy but may resolve after the baby is delivered. Some of the signs and symptoms of type 1 and type 2 diabetes are: increased thirst; frequent urination; extreme hunger; unexplained weight loss; presence of ketones in the urine (ketones are a byproduct of the breakdown of muscle and fat that happens when there's not enough available insulin); fatigue; irritability; blurred vision; slow-healing sores; frequent infections, such as gums or skin infections and vaginal infections.

Type 1 diabetes can develop at any age, though it often appears during childhood or adolescence. Type 2 diabetes, the more common type, can develop in people older than 40. Prediabetes can lead to type 2 diabetes and in type 2 diabetes, cells become resistant to the action of insulin, and pancreas is unable to make enough insulin to overcome this resistance. Instead of moving into cells where it's needed for energy, sugar builds up in the bloodstream. During pregnancy, the placenta produces hormones to sustain the pregnancy. These hormones make the cells more resistant to insulin. Long-term complications of diabetes develop gradually. Eventually, diabetes complications may be disabling or even life-threatening. Possible complications include:

- Cardiovascular disease- Diabetes dramatically increases the risk of various cardiovascular problems, including coronary artery disease with chest pain (angina), heart attack, stroke and narrowing of arteries (atherosclerosis).
- Nerve damage (neuropathy)- Excess sugar can injure the walls of the tiny blood vessels (capillaries) that nourish the nerves, especially in the legs. This can cause tingling, numbness, burning or pain that usually begins at the tips of the toes or fingers and gradually spreads upward.

- Kidney damage (nephropathy)- The kidneys contain millions of tiny blood vessel clusters (glomeruli) that filter waste from the blood. Diabetes can damage this delicate filtering system. Severe damage can lead to kidney failure or irreversible end-stage kidney disease, which may require dialysis or a kidney transplant.
- Eye damage (retinopathy)- Diabetes can damage the blood vessels of the retina (diabetic retinopathy), potentially leading to blindness. Diabetes also increases the risk of other serious vision conditions, such as cataracts and glaucoma.
- Foot damage- Nerve damage in the feet or poor blood flow to the feet increases the risk of various foot complications. Left untreated, cuts and blisters can develop serious infections, which often heal poorly. These infections may ultimately require toe, foot or leg amputation.
- Skin conditions- Diabetes may leave more susceptible to skin problems, including bacterial and fungal infections.
- Hearing impairment- Hearing problems are more common in people with diabetes.
- Alzheimer's disease- Type 2 diabetes may increase the risk of dementia, such as Alzheimer's disease.
- Depression- Depression symptoms are common in people with type 1 and type 2 diabetes. Depression can affect diabetes management.

Prevention: Type 1 diabetes can't be prevented. However, the same healthy lifestyle choices that help treat prediabetes, type 2 diabetes and gestational diabetes can also help prevent them:

- Healthy diet.
- More physical activity.

Sometimes medication is an option as well. Oral diabetes drugs such as metformin (Glucophage, Glumetza, others) may reduce the risk of type 2 diabetes.

Irritable Bowel Syndrome: Irritable bowel syndrome (IBS) is a condition where the muscles in the digestive tract (large intestine) do not function properly. Food ends up getting pushed along too quickly or too slowly. Symptoms include intermittent bouts of diarrhea and constipation, bloating, gas, loss of appetite and emotional distress.

Narcolepsy: Narcolepsy is a chronic sleep disorder characterized by overwhelming daytime drowsiness and sudden attacks of sleep. People with narcolepsy often find it difficult to stay awake for long periods of time, regardless of the circumstances. It is characterized by a constant feeling of fatigue and sleepiness that can also include dream-like hallucinations and moments where the individual is paralyzed.

Cataracts: A cataract is a dense, cloudy area that forms in the lens of the eye. A cataract begins when proteins in the eye form clumps that prevent the lens from sending clear images to the retina. It develops slowly and eventually interferes with vision. Cataracts are common in older people. Common symptoms of cataracts include: blurry vision; trouble seeing at night; seeing colors as faded; increased sensitivity to glare; halos surrounding lights; double vision in the affected eye; a need for frequent changes in prescription glasses.

Osteoporosis: This is a noninfectious disease that most commonly takes place in older women and it is characterized by a low bone mineral density. Bones can become weak and brittle with this disease, and be more prone to getting fractured. Signs and symptoms that include: Back pain, caused by a fractured or collapsed vertebra, loss of height over time, a stooped posture, a bone fracture that occurs much more easily than expected.

Chronic kidney disease: Chronic kidney disease, also called chronic kidney failure, describes the gradual loss of kidney function which results in the increased accumulation of fluid, electrolytes and wastes in the body. Treatment for chronic kidney disease focuses on slowing the progression of the kidney damage, usually by controlling the underlying cause. Chronic kidney disease can progress to end-stage kidney failure, which is fatal without artificial filtering (dialysis) or a kidney transplant. Signs and symptoms of chronic kidney disease may include: nausea, vomiting, loss of appetite, fatigue and weakness, sleep problems, changes in how much you urinate, decreased mental sharpness, muscle twitches and cramps, swelling of feet and ankles, persistent itching, chest pain, if fluid

builds up around the lining of the heart, shortness of breath, if fluid builds up in the lungs, high blood pressure (hypertension) that's difficult to control.

Alzheimer's disease: Alzheimer's disease is a progressive disease that destroys memory and other important mental functions. Alzheimer's disease is the most common cause of dementia (a group of brain disorders that cause the loss of intellectual and social skills) where, the brain cells degenerate and die, causing a steady decline in memory and mental function. Symptoms: increasing forgetfulness or mild confusion may be the only symptoms of Alzheimer's disease The rate at which symptoms worsen varies from person to person.

Cardiovascular disease (CVD): is a class of diseases that involve the heart or blood vessels. Cardiovascular disease includes
Coronary artery diseases (CAD): The coronary arteries supply the heart muscle with nutrients and oxygen by circulating blood. Coronary arteries can become diseased or damaged, usually because of plaque deposits that contain cholesterol. Plaque build up narrows the coronary arteries, and this causes the heart to receive less oxygen and nutrients.

Deficiency Diseases: Diseases that occur due to lack of essential dietary elements, especially a vitamin or minerals over a long period are called deficiency diseases or nutritional disease. Deficiency of one or more nutrients can cause diseases or disorders in the body.

Diseases caused by nutritional deficiencies:
1. Rickets: Deficiency of Vitamin D along with calcium and potassium in the body causes rickets. Rickets is characterized by weak and soft bones, bowed legs and bone deformities. Fish, fortified dairy products, liver, oil and sunlight are some rich sources of Vitamin D. One may need to resort to dietary supplements for making up for the lack of the “sunshine vitamin” in the body.

2. Pellagra: Dementia, diarrhea, dermatitis and death are “the four Ds” that characterize Pellagra, a disease caused by the lack of Niacin or B3 in the body. The deficiency of niacin is also accompanied by a short supply of the amino acids, tryptophan and lysine or the excessive presence of lysine in the body. Foods enriched with niacin are tuna, whole grains, peanuts, mushrooms, chicken etc.

3. Scurvy: Alarmingly reduced levels of Vitamin C or ascorbic acid in the body can cause scurvy. Scurvy basically inhibits the production of collagen in the body which is the structural protein that connects the tissues. Decaying of the skin and gums, abnormal formation of teeth and bones, delay or inability to heal wounds and bleeding are the effects of scurvy on the body. One must ensure optimal consumption of Vitamin C by having citrus fruits like oranges, lemon, strawberry etc and broccoli regularly.

4. Beri Beri and Wernicke-Korsakoff disease: Lack of Vitamin B1 or thiamine in the body leads to the disease called Beri Beri and Wernicke-Korsakoff disease. The most common symptoms of this illness are altered muscle coordination, nerve degeneration and cardiovascular problems. Meat, eggs, whole grains, dried beans etc are rich in thiamine.

5. Xerophthalmia or Night Blindness: Xerophthalmia or night blindness is characterized by blindness due to the poor growth, dryness and keratinisation of epithelial tissue or chronic eye infection. The cause of this disease is attributed to the deficiency of Vitamin A in the body. In worsened situations, night blindness can aggravate to complete loss of vision. The safest way to enhance the Vitamin A levels in the body is by consuming natural food sources like carrots, green and leafy vegetables, cantaloupes etc.

6. Goitre: Iodine in the body is essential for normal cell metabolism and deficiency of iodine may cause goitre. Goitre leads to enlarged thyroid glands causing hypothyroidism, poor growth and development of infants, cretinism and even mental retardation. This disease is commonly found to occur in places having iodine deficit soil. Iodised salt and saltwater fish are rich sources of iodine, and must be consumed regularly to avoid goitre.

7. Iron Deficiency Anaemia: Iron deficiency anaemia is a disease caused by the deficiency of iron in the body. It is characterized by a decrease in the red blood cell count or hemoglobin in the body, resulting in fatigue, weakness, dyspnoea and paleness of the body. It can be easily treated by changing to a healthy diet and consuming iron supplements (Squashes, nuts, tofu, bran etc) on a regular basis.

8. Kwashiorkor: Kwashiorkor is a deficiency disease caused by lack of protein and energy in the body. It is characterized by anorexia, an enlarged liver, irritability and ulcerating dermatoses. These are the one of the nutritional deficiencies in children, especially from famine-struck areas and places with poor food supply, Kwashiokor is caused by malnutrition. A healthy and balanced diet enriched with protein and carbohydrate sources like eggs, lentils, rice etc helps combat this problem.

9. Depression: Problems of depression, hair loss, rashes and mental issues are caused by the deficiency of Vitamin B7 or biotin. Consume poultry products, dairy items, peanuts, nuts etc that are rich sources of biotin. These must be consumed along with other supplements to recover and prevent theis illnesses.

10. Osteoporosis: Deficiency of Vitamin D and calcium in the body can negatively affect the health of the bones and spine. It leads to unhealthy, soft and brittle bones that are prone to fractures and defects in the spine structure. Bananas, spinach, milk, okra, soy and sunlight are natural sources of Vitamin D and calcium that act to eliminate this deficiency.

Occupational disease: An occupational disease is any chronic ailment that occurs as a result of work or occupational activity. An occupational disease is typically identified when it is shown that it is more prevalent in a given body of workers than in the general population, or in other worker populations. The first such disease to be recognised, squamous-cell carcinoma of the scrotum, was identified in chimney sweep boys in 1775.

Some well-known occupational diseases include:

Lung diseases: Occupational lung diseases are occupational, or work-related, lung conditions that have been caused or made worse by the materials a person is exposed to within the workplace. Occupational asthma has a vast number of occupations at risk. Bad indoor air quality may predispose for diseases in the lungs as well as in other parts of the body.

Asbestosis is long term inflammation and scarring of the lungs due to asbestos (a set of six naturally occurring silicate minerals). Asbestosis is caused by breathing in asbestos fibers. Generally it requires a relatively large exposure over a long period of time. Such levels of exposure typically only occur in those who work with the material. Asbestosis affected about 157,000 people and resulted in 3,600 deaths in 2015. Asbestos use has been banned in a number of countries in an effort to prevent disease.

Symptoms of Asbestosis: When scar tissue forms around the lungs' microscopic air sacs, it gradually becomes harder for them to expand and fill with fresh air.

This can cause a series of symptoms, including: shortness of breath; persistent dry cough; chest tightness and pain; fatigue; loss of weight and appetite; crackling sound when breathing; Pulmonary hypertension; Clubbed fingers and toes

Asbestosis Treatment: Asbestosis is an irreversible condition. Because the condition gets worse over time, patients require increased treatment as they age. Supplemental oxygen; Medications (anti-inflammatory medications and immunosuppressants); pulmonary rehabilitation; lung transplants

Pneumoconiosis is an occupational lung disease and a restrictive lung disease caused by the inhalation of dust, often in mines and from agriculture. In 2013, it resulted in 260,000 deaths globally, up from 251,000 deaths in 1990.

Byssinosis, is an occupational lung disease caused by exposure to cotton dust in inadequately ventilated working environments. Byssinosis commonly occurs in workers who are employed in yarn and fabric manufacture industries.

Symptoms: Breathing difficulties; chest tightness; wheezing; cough; brown lung can ultimately result in narrowing of the airways, lung scarring and death from infection or respiratory failure

Treatment: Affected workers should be offered alternative employment. Continued exposure leads to development of persistent symptoms and progressive decline in FEV1.

Occupational lung disease	**Causative agent**
Asbestosis	Asbestos
Stannosis	Tin oxide
Byssinosis (brown lung disease)	Cotton
Siderosis	Iron
Aluminosis	Aluminium
Pneumoconiosis (also known as miner's lung, black lung)	Coal, carbon, agriculture
Silicosis	Crystalline silica dust

Skin diseases: Occupational skin diseases are ranked among the top five occupational diseases in many countries. Occupational skin diseases and conditions are generally caused by chemicals and having wet hands for long periods while at work. Eczema is by far the most common, but urticaria, sunburn and skin cancer are also of concern.

Contact dermatitis due to irritation is inflammation of the skin which results from a contact with an irritant. It has been observed that this type of dermatitis does not require prior sensitization of the immune system. There have been studies to support that past or present atopic dermatitis is a risk factor for this type of dermatitis. Common irritants include detergents, acids, alkalies, oils, organic solvents and reducing agents.

The acute form of this dermatitis develops on exposure of the skin to a strong irritant or caustic chemical. This exposure can occur as a result of accident at a workplace. The irritant reaction starts to increase in its intensity within minutes to hours of exposure to the irritant and reaches its peak quickly. After the reaction has reached its peak level, it starts to heal. The most frequent potent irritants leading to this type of dermatitis are acids and alkaline solutions. The symptoms include redness and swelling of the skin along with the formation of blisters. The chronic form occurs as a result of repeated exposure of the skin to weak irritants over long periods of time.

Another occupational skin disease is Glove related hand urticaria. It has been reported as an occupational problem among the health care workers. This type of hand urticaria is believed to be caused by repeated wearing and removal of the gloves. The reaction is caused by the latex or the nitrile present in the gloves. Symptoms includes a kind of skin rash with red, raised, itchy bumps.They may also burn or sting. Often the patches of rash move around. Typically they last a few days and do not leave any long-lasting skin changes. Fewer than 5% of cases last for more than six weeks.

Eye disease: Miners' nystagmus is a disease which incapacitates a large number of coalminers caused due to the light. It is characterised by rapid involuntary movements of the eyes, associated with defect of vision, photophobia, and night-blindness.

Other diseases of concern:

- Overuse syndrome among persons who perform repetitive or forceful movements in constrictive postures

- Carpal tunnel syndrome among persons who work in the poultry industry and information technology
- Computer vision syndrome among persons using information technology for hours
- Lead poisoning affecting workers in many industries that processed or employed lead or lead compounds

Prevention measures include avoidance of the irritant through its removal from the workplace or through technical shielding by the use of potent irritants in closed systems or automation, irritant replacement or removal and personal protection of the workers.

In order to better prevent and control occupational disease, most countries revise and update their related laws, most of them greatly increasing the penalties in case of breaches of the occupational disease laws. Occupational disease prevention, in general legally regulated, is part of good supply chain management and enables companies to design and ensure supply chain social compliance schemes as well as monitor their implementation to identify and prevent occupational disease hazards.

Incubation period: is the time from the moment of exposure to an infectious agent until signs and symptoms of the disease appear. In a typical infectious disease, incubation period signifies the period taken by the multiplying organism to reach a threshold necessary to produce symptoms in the host.

While latent or latency period may be synonymous, a distinction is sometimes made between incubation period, the period between infection and onset of the disease, and latent period, the time from infection to infectiousness. Which is shorter depends on the disease. A person may be a carrier of a disease, such as *Streptococcus* in the throat, without exhibiting any symptoms. Depending on the disease, the person may or may not be contagious during the incubation period.

During latency, an infection is subclinical. With respect to viral infections, in latency the virus is replicating. An example of latency is HIV infection. HIV may at first have no symptoms and show no signs of AIDS, despite HIV replicating in the lymphatic system and rapidly accumulating a large viral load. These persons may be infectious.

The terms "intrinsic incubation period" and "extrinsic incubation period" are used in vector-borne diseases. The intrinsic incubation period is the time taken by an organism to complete its development in the definitive host. The extrinsic incubation period is the time taken by an organism to complete its development in the intermediate host.

For example, once ingested by a mosquito, malaria parasites must undergo development within the mosquito before they are infectious to humans. The time required for development in the mosquito ranges from 10 to 28 days, depending on the parasite species and the temperature. This is the extrinsic incubation period of that parasite. If a female mosquito does not survive longer than the extrinsic incubation period, then she will not be able to transmit any malaria parasites. After a mosquito successfully transfers the parasite to a human body via a bite, the parasite starts developing. The time between the injection of the parasite into the human and the development of the first symptoms of malaria is its intrinsic incubation period

Disease	**Incubation period** (days)
Cellulitis	0 – 1
Chicken pox	9 – 21
Cholera	0.5 – 4.5
Erythema infectiosum	13 – 18
Common cold; Influenza	1 – 3
Dengue fever	3 – 14
Ebola	1 – 21
Roseola	5 – 15
HIV	2 – 3
Measles	9 – 12
Rabies	1 – 3
SARS	1 – 10
Scarlet fever	1 – 4

Pertussis; Polio	7 – 14
Small pox	7 – 17
Tetanus	7 – 21

Mortality rate or **death rate**, is a measure of the number of deaths (in general, or due to a specific cause) in a particular population, scaled to the size of that population, per unit of time. Mortality rate is typically expressed in units of deaths per 1,000 individuals per year; thus, a mortality rate of 9.5 (out of 1,000) in a population of 1,000 would mean 9.5 deaths per year in that entire population.

Other specific measures of mortality include:

- Crude death rate – the total number of deaths per year per 1,000 people.
- Perinatal mortality rate – the sum of neonatal deaths and fetal deaths (stillbirths) per 1,000 births.
- Maternal mortality ratio – the number of maternal deaths per 1,000 live births in same time period.
- Maternal mortality rate – the number of maternal deaths per 1,000 women of reproductive age in the population (generally defined as 15–44 years of age).
- Infant mortality rate – the number of deaths of children less than 1 year old per 1,000 live births.
- Child mortality rate: the number of deaths of children less than 5 years old per 1,000 live births.
- Age-specific mortality rate (ASMR) – the total number of deaths per year per 1,000 people of a given age (e.g. age 62 last birthdays).
- Cause-specific mortality rate – the mortality rate for a specified cause of death.
- Cumulative death rate: a measure of the (growing) proportion of a group that die over a specified period (often as estimated by techniques that account for missing data by statistical censoring).
- Case fatality rate (CFR) – the proportion of cases of a particular medical condition that lead to death.
- Sex-specific mortality rate - Total number of deaths in a population of a specific sex within a given time interval

Nosocomial infection: A nosocomial infection, also known as a hospital-acquired infection or HAI, is an infection whose development is favoured by a hospital environment, such as one acquired by a patient during a hospital visit, or one developed among hospital staff. Such infections include fungal and bacterial infections, and are aggravated by the reduced resistance of individual patients. Numerous risk factors in the hospital setting predispose a patient to infection.

These risk factors can broadly be divided into three areas.

- People in hospitals are usually already in a 'poor state of health', impairing their defence against bacteria. Advanced age or premature birth, along with immunodeficiency (due to drugs, illness, or irradiation) presents a general risk, while other diseases can present specific risks.
- Invasive devices, for instance intubation tubes, catheters, surgical drains, and tracheostomy tubes all bypass the body's natural lines of defence against pathogens and provide an easy route for infection. Patients already colonized at the time of admission are instantly put at greater risk when they undergo invasive procedures.
- Patients treatments can leave them vulnerable to infection: immunosuppression and antacid treatment undermine the body's defences, while antimicrobial therapy (removing competitive flora and only leaving resistant organisms) and recurrent blood transfusions have also been identified as risk factors.

Types of nosocomial infections:

National Healthcare Safety Network with Center for Disease Control (CDC) for surveillance has classified nosocomial infection sites into 13 types, with 50 infection sites, which are specific on the basis of biological and clinical criteria.

Known nosocomial infections include:

- Hospital-acquired pneumonia (Ventilator-associated pneumonia)
- Tuberculosis
- Urinary tract infection
- Gastroenteritis
- Colitis
- Legionnaires' disease

Chain of Transmission**:** The most important and frequent mode of transmission of nosocomial infections is by contact. Contact transmission is divided into two subgroups: direct-contact transmission and indirect-contact transmission.

Direct-contact transmission involves a direct body surface-to-body surface contact and physical transfer of microorganisms between a susceptible host and an infected or colonized person, such as when a person turns a patient, gives a patient a bath, or performs other patient-care activities that require direct personal contact. Direct-contact transmission can also occur between two patients, with one serving as the source of the infectious microorganisms and the other as a susceptible host.

Indirect-contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, such as contaminated instruments, needles, or dressings, or contaminated gloves that are not changed between patients. In addition, the improper use of saline flush syringes, vials, bags, gloves, disposable needles, intravenous devices, and flushes has been implicated in disease transmission.

Common vehicle transmission applies to microorganisms transmitted to the host by contaminated items, such as food, water, medications, devices, and equipment. Vector borne transmission occurs when vectors such as mosquitoes, flies, rats, and other vermin transmit microorganisms.

Agents	Characteristic	Colonization	Diseases	Virulence factors	Drug resistance
S. aureus	Gram-positive facultatively anaerobic cocci		Staphylococcal scalded skin syndrome, Toxic shock syndrome, Food poisoning	toxins, enzymes and immune modulators	Methicillin, Cephalosporins, Aminoglycosides
E. coli	Gram-negative facultative anaerobe bacteria	Gastro-intestinal tract	UTI, Septicemia Pneumonia, Neonatal Meningitis, Peritonitis, Gastroenteritis	endotoxins, capsule, adhesions; type 3 secretion systems	
Vancomycin-resistant *enterococci*	Gram-positive facultative anaerobic	Female genital tract and gastro-intestinal tract	Blood-Borne Infections, UTI, Wound Infections Consort To Surgical Procedures	extracellular surface proteins, cytolysin, adhesions, hemolysins, ge latinase, extracellular superoxide and aggregation substances	Penicillin, Ampicillin, Aminoglycosides, Tetracyclines, Carbapenems, Fluoroquinolones and Macrolides
K. pneumoni a	Gram-positive bacillus	Gastro-intestinal tract, pharynx and skin	Neonatal Septicaemia, Pneumonia, Wound Infections, Septicemia	endotoxins, cell wall receptors and capsular polysaccharide	Cephalosporins, β-lactam antibiotics
P. aeruginos	Gram-	Kidney,	Surgical and Wound	adhesions, hemolysins,	Cephalosporins, Trime

a	negative	urinary tract and upper respiratory tract	Infections, UTI, Pneumonia, Cystic Fibrosis and Bacteremi a	exotoxins, proteases and s iderophores	thoprim, Macrolides, Chloramphenicol, Tetracyclines and Fluoroquinolones
Clostridium difficile	Gram-positive anaerobic and spore-forming bacillus	Intestinal tract	Diarrhea	toxins, fimbriae, capsule and hydrolytic enzymes	Cephalosporins, Fluoroquinolones, Clindamycins and Ampicillins

Agents of nosocomial infections	**Chain of Transmission**
S. aureus	Through infected individuals' skin or contact via shared items and surfaces like door handles, benches, towels and taps
E. coli	Through person to person, environment or contaminated water and food
Vancomycin-resistant *enterococci*	Patients with diarrhea are common means of transmission. Their room items such as surfaces and equipments act as reservoirs.
K. pneumonia	In hospital settings, *K. pneumonia* can be transmitted by person-to-person contact and especially when healthcare professionals do not wash or clean hands after checking a contaminated patient. Respiratory machines, catheters or exposed wounds can be the source of its transmission. *K. pneumoniae* is reported to be transmitted through stool (77%), patients' hands (42%) and pharynx (19%)
P. aeruginosa	Common reservoirs for its contamination include breast pumps, incubators, sinks and hands of hospital staff and hand soaps
C. difficile	Spores of *C. difficile* can hold for months and become a problem for disinfectants and cleaning agents. Inanimate objects and infected intestinal patients are major sites acted as reservoirs.

Prevention: Hospitals have sanitation protocols regarding uniforms, equipment sterilization, washing, and other preventive measures. Thorough hand washing and/or use of alcohol rubs by all medical personnel before and after each patient contact is one of the most effective ways to combat nosocomial infections. More careful use of antimicrobial agents, such as antibiotics, is also considered vital.

Sterilization goes further than just sanitizing. It kills all microorganisms on equipment and surfaces through exposure to chemicals, ionizing radiation, dry heat, or steam under pressure.

Unit- I; Possible Questions

Part-A (1 Mark)

Part-B (2 Mark)

1. What are infectious diseases? give an example.
2. What are nonmicrobial diseases? Give an example.
3. Define incubation period.
4. Define mortality rate.
5. What are microbial diseases?
6. Define deficiency and occupational diseases.
7. Define nosocomial infections.

Part-C (8 Mark)

1. Write a note on infectious and microbial diseases.
2. Write a note on noninfectious and nonmicrobial diseases.
3. Give a detailed note on deficiency.
4. Write in details about nosocomial diseases.
5. Write a note on incubation period and mortality rate.

KARPAGAM ACADEMY OF HIGHER EDUCATION

CLASS: III B.Sc MB COURSE NAME: Management of Human Microbial Diseases

COURSE CODE: 17MBU501A UNIT: I BATCH-2017-2020

Sl.No	Questions	Opt A	Opt B	Opt C	Opt D	Answer
1	Diseases which are caused by microorganisms are called _____.	Venereal	Infectious	Incurable	Contagious	Infectious
2	Miner's nystagmus is caused due to _____.	Light	Noise	Heat	Radiation	Light
3	Niacin deficiency is a common cause of _____.	Beri beri	Pellagra	Scurvy	Rickets	Pellagra
4	A hospital acquired infection is called _____.	Familial	Potential	Genial	Nosocomial	Nosocomial
5	The infectious agent of Cat scratch disease is _____	*Borrelia sp.*	*Giardia*	*Bartonella sp.*	*T. Gondii*	*Bartonella sp.*
6	Asbestosis is an example of _____.	Nosocomial infection	Occupational disease	Deficiency disease	Microbial disease	Occupational disease
7	Thiamine deficiency is a common cause of _____.	Beri beri	Pellagra	Scurvy	Rickets	Beri beri
8	Which of the following are causative agents of nosocomial infections?	*Staphylococcus epidermidis*	*Pseudomonas aeruginosa*	*Clostridium difficile*	All the above	All the above
9	Biotin deficiency is a common cause of _____.	Beri beri	Goitre	Scurvy	Depression	Depression
10	Vitamin A deficiency is a common cause of _____.	Goitre	Depression	Night blindness	Kwashiokor	Night blindness
11	The infectious agent of Lyme disease is _____.	*Borrelia sp.*	*Giardia*	*Bartonella sp.*	*T. Gondii*	*Borrelia sp.*
12	In some of the cases, cervical cancer can be attributable to ____ infection.	HPV	HIV	Hepatitis B	HSV	HPV
13	Chagos disease is caused by _____.	*Giardia*	*Bartonella sp.*	*T. Gondii*	*Trypanosoma cruzi*	*Trypanosoma cruzi*

14	A deer tick might infect a person with _____, the bacterium that causes Lyme disease	*Borrelia sp.*	*Giardia*	*Bartonella sp.*	*T. Gondii*	*Borrelia sp.*
15	_____ are the incubation period of Rabies.	2 to 3 days	2 to 7 days	1 to 3 days	4 to 8 days	1 to 3 days
16	Siderosis is caused by breathing in _____.	Asbestos	Tin oxide	Cotton	Iron	Iron
17	_____ is the total number of deaths per year per 1000 people.	Cumulative death rate	Crude death rate	Perinatal mortality rate	Maternal mortality rate	Crude death rate
18	_____ is the number of deaths of children less than 1 year old per 1,000 live births.	Child mortality rate	Age-specific mortality rate	Perinatal mortality rate	Infant mortality rate	Infant mortality rate
19	_____ are the incubation period of small pox.	*7 to 17 days*	*2 to 21 days*	*10 to 21 days*	*4 to 10 days*	7 to 17 days
20	CDC for surveillance has classified nosocomial infection sites into __ types, with 50 infection sites	10	11	12	13	13
21	_____ is a condition where the intestine suffers a bad reaction to gluten-containing products	Multiple sclerosis	Narcolepsy	Celiac disease	Lupus:	Celiac disease
22	In some of the cases, liver cancer can be attributable to ____ infection.	HPV	HIV	Hepatitis B and C	HSV	Hepatitis B and C
23	Osteoporosis is characterized by _____.	Mild confusion	Weak and brittle bones	Muscle twitches and cramps	Constipation	Weak and brittle bones
24	Which one of the following is an occupational skin disease?	Eczema	Contact dermatitis	Urticaria	All the above	All the above
25	The terms "intrinsic incubation period" and "extrinsic incubation period" are used in _____ diseases	Insect-borne	Mosquito-borne	Parasites-borne	Vector-borne	Vector-borne
26	_____ is the proportion of cases of a particular medical condition that lead to	Case fatality rate	Age-specific mortality rate	Cumulative death rate	Sex-specific mortality rate	Case fatality rate

	death.					
27	_____is the time taken by an organism to complete its development in the intermediate host	Intrinsic incubation period	Extrinsic incubation period	Both A and B	None of the above	Extrinsic incubation period
28	_____ are the incubation period of Ebola.	1 to 10 days	*7 to 17 days*	1 to 21 days	*2 to 12 days*	1 to 21 days
29	Pneumoconiosis is also called as _____.	Black lung	Miner's lung	Both A and B	None of the above	Both A and B
30	Asbestosis is caused by breathing in _____.	Asbestos fibers.	Cotton	Aluminium	Crystalline silica dust	Asbestos fibers.
31	Iorn deficiency is a common cause of _____.	Beri beri	Goitre	Scurvy	Rickets	Goitre
32	_____are the incubation period of C. tetani.	*7 to 10 days*	*2 to 21 days*	*7 to 21 days*	*4 to 30 days*	*7 to 21 days*
33	Irritable Bowel Syndrome is characterized by _____.	Mild confusion	Weak and brittle bones	Muscle twitches and cramps	Constipation	Constipation
34	_____ are the incubation period of SARS.	2 to 3 days	2 to 7 days	1 to 10 days	4 to 8 days	1 to 10 days
35	The first occupational disease is squamous-cell carcinoma of the scrotum, was identified in chimney sweep boys in _____.	*1785*	*1775*	*1776*	*1786*	*1775*
36	_____ is period is the time taken by an organism to complete its development in the definitive host	Intrinsic incubation period	Extrinsic incubation period	Both A and B	None of the above	Intrinsic incubation period
37	Byssinosis is caused by breathing in _____.	Asbestos fibers.	Cotton	Aluminium	Crystalline silica dust	Cotton
38	_____ is virulence factor of *E. coli.*	Endotoxins	Capsule	Adhesions	All the above	All the above
39	Neonatal Septicaemia is caused by _____.	*Clostridium difficile*	*K. Pneumonia*	*P. Aeruginosa*	*S. Aureus*	*K. Pneumonia*
40	_____ among persons who work in	Overuse syndrome	Computer vision	Carpal tunnel	Lead poisoning	Carpal tunnel

	the poultry industry and information technology		syndrome	syndrome		syndrome
41	Common reservoirs for _____ contamination are person to person, environment or contaminated water and food	*P. Aeruginosa*	*C. Difficile*	*E. Coli*	*K. Pneumonia*	*E. Coli*
42	_____ affecting workers in many industries that processed or employed lead or lead compounds	Overuse syndrome	Computer vision syndrome	Carpal tunnel syndrome	Lead poisoning	Lead poisoning
43	Toxic shock syndrome is caused by _____.	*Clostridium difficile*	*K. Pneumonia*	*P. Aeruginosa*	*S. Aureus*	*S. Aureus*
44	_____ is virulence factor of Vancomycin-resistant *enterococci*	Capsular polysaccharide	Capsule	Immune modulators	Cytolysin	Cytolysin
45	Staphylococcal scalded skin syndrome is caused by _____.	*Clostridium difficile*	*K. Pneumonia*	*P. Aeruginosa*	*S. Aureus*	*S. Aureus*
46	_____ is virulence factor of *S. aureus*	Capsular polysaccharide	Capsule	Immune modulators	Cytolysin	Immune modulators
47	_____ is a disease caused by the deficiency of iron in the body	Anaemia	Xerophthalmia	Depression	Wernicke-Korsakoff disease	Anaemia
48	Common reservoirs for _____ contamination include breast pumps, incubators, sinks and hands of hospital staff and hand soaps	*P. Aeruginosa*	*C. Difficile*	*E. Coli*	*K. Pneumonia*	*P. Aeruginosa*
49	_____ is the inflammation of the heart or its surroundings.	Pulmonary stenosis	A congenital heart defect	Heart arrhythmia	Carditis	Carditis
50	In _____, immune system attacks the protective sheath (myelin) that covers nerve fibers	Lupus	Multiple sclerosis	Celiac disease	Narcolepsy:	Multiple sclerosis
51	The most distinctive sign of _____ are	Rheumatoid arthritis	Diabetes	Lupus	Alzheimer's	Lupus

	facial rash that resembles the wings of a butterfly unfolding across both cheeks				disease	
52	Asbestosis affected about 157,000 people and resulted in _____ deaths in 2015	4,900	3,600	2,600	3,100	3,600
53	Myalgia reffers to _____.	Abnormal voice changes	Swallowing	A deep barking cough	Pain in a muscle	Pain in a muscle
54	_____ due to irritation is inflammation of the skin which results from a contact with an irritant	Skin cancer	Urticaria	Eczema	Contact dermatitis	Contact dermatitis
55	*Varicella* has an incubation period of _____ days.	10 to 21	12 to 15	5 to 10	15 to 21	10 to 21
56	Hepatitis B is a serious infection of the ____ caused by a virus	Kidney	Liver	Nervous system	Skin	Liver
57	_____ of the Pteropodidae family are natural *Ebola* virus hosts	Pigs	Fruit bats	Dogs	Cats	Fruit bats
58	In 2013, Pneumoconiosis resulted in 260,000 deaths globally, up from 251,000 deaths in _____.	1990	1995	2005	2015	1990
59	Which one of the following is an autoimmune disease?	Rheumatoid arthritis	Diabetes	Cardiovascular disease	Alzheimer's disease	Rheumatoid arthritis
60	_____ is an enlargement (dilation) of the aorta to greater than 1.5 times normal size	Pulmonary stenosis	A congenital heart defect	Aortic aneurysm	Carditis	Aortic aneurysm

Unit -II

Syllabus

Respiratory microbial diseases, gastrointestinal microbial diseases, Nervous system diseases, skin diseases, eye diseases, urinary tract diseases, Sexually transmitted diseases: Types, route of infection, clinical systems and general prevention methods, study of recent outbreaks of human diseases (SARS/ Swine flu/Ebola) – causes, spread and control, Mosquito borne disease – Types and prevention.

Microbial diseases of Respiratory System:

1. Upper Respiratory Infections: Acute upper respiratory infections (URI) include the common cold, pharyngitis, epiglottitis, and laryngotracheitis.

(a) Common Cold: Most colds are caused by viruses. *Rhinoviruses* with more than 100 serotypes are the most common pathogens, causing at least 25 % of colds in adults. *Coronaviruses* may be responsible for more than 10 % of cases. *Parainfluenza* viruses, respiratory *syncytial* virus, *adenoviruses* and *Influenza* viruses have all been linked to the common cold syndrome. All of these organisms show seasonal variations in incidence.
Clinical symptoms: After an incubation period of 48–72 hours, classic symptoms of nasal discharge and obstruction, sneezing, sore throat and cough occur in both adults and children. Myalgia (pain in a muscle or group of muscles) and headache may also be present. Fever is rare. The duration of symptoms and of viral shedding varies with the pathogen and the age of the patient.
Prevention: Restriction of activities to avoid infecting others, along with good hand washing, is the best measures to prevent spread of the disease. No vaccine is commercially available for cold prophylaxis.

(b) Sinusitis: Acute sinusitis most often follows a common cold which is usually of viral etiology. Vasomotor (dilatation of blood vessels) and allergic rhinitis (stuffy nose) may also be antecedent to the development of sinusitis. The most common bacterial agents responsible for acute sinusitis are *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, *Staphylococcus aureus*, and *Streptococcus pyogenes*. Chronic sinusitis is commonly a mixed infection of aerobic and anaerobic organisms.
Clinical symptoms: Pain, sensation of pressure, tenderness, low grade fever over the affected sinus are present. Physical examination usually is not remarkable with no more than an edematous and hyperemic nasal mucosa. In uncomplicated chronic sinusitis, a purulent nasal discharge is the most constant finding. Thickening of the sinus mucosa and a fluid level are usually seen in x-ray films or magnetic resonance imaging.
Prevention: Specific preventive procedures are not available. Root abscesses of the upper teeth should receive proper dental care to avoid secondary infection of the maxillary sinuses.

(c) Pharyngitis: Pharyngitis is an inflammation of the pharynx involving lymphoid tissues of the posterior pharynx and lateral pharyngeal bands. The etiology can be bacterial, viral and fungal infections as well as noninfectious etiologies such as smoking. Type A coxsackie viruses can cause a severe ulcerative pharyngitis in children (herpangina), and adenovirus and herpes simplex virus, although less common, also can cause severe pharyngitis. Group A beta-hemolytic *Streptococcus* or *Streptococcus pyogenes* is the most important bacterial agent associated with acute pharyngitis and tonsillitis. *Corynebacterium diphtheriae*, *Corynebacterium haemolyticum*, *Neisseria gonorrhoeae*, and *Chlamydia trachomatis* causes occasional cases of acute pharyngitis. *Mycoplasma pneumoniae* and *Mycoplasma hominis* have been associated with acute pharyngitis. *Candida albicans*, which causes oral candidiasis or thrush, can involve the pharynx, leading to inflammation and pain.
Clinical symptoms: Pharyngitis usually presents with a red, sore, or "scratchy" throat. An inflammatory exudate or membranes may cover the tonsils and tonsillar pillars. Ulcers may also be seen on the pharyngeal walls.

Depending on the pathogen, fever and systemic manifestations such as myalgia, or headache may be present. Anterior cervical lymphadenopathy (is disease of the lymph nodes, in which they are abnormal in size, number, or consistenc) is common in bacterial pharyngitis and difficulty in swallowing may be present.

Prevention: Avoid sharing food, drinks, and utensils; avoid individuals who are sick; wash ther hands often, especially before eating and after coughing or sneezing

(d) Epiglottitis or Laryngotracheitis: Inflammation of the upper airway is classified as epiglottitis or laryngotracheitis (croup) on the basis of the location, clinical manifestations, and pathogens of the infection. *Haemophilus influenzae* type B is the most common cause of epiglottitis, particularly in children age 2 to 5 years. More serious bacterial infections have been associated with *H influenzae* type B, group A beta-hemolytic *Streptococcus* and *C diphtheriae*. *Parainfluenza* viruses are most common but respiratory syncytial virus, *adenoviruses*, *influenza* viruses, *enteroviruses* and *Mycoplasma pneumoniae* have been implicated.

Clinical symptoms: The syndrome of epiglottitis begins with the acute onset of fever, sore throat, hoarseness (abnormal voice changes), drooling (drop saliva uncontrollably from the mouth.), dysphagia (difficulty swallowing) and progresses within a few hours to severe respiratory distress and prostration. A history of preceding cold-like symptoms is typical of laryngotracheitis, with rhinorrhea, fever, sore throat and a mild cough. Tachypnea (a deep barking cough) and inspiratory stridor eventually develop. Children with bacterial tracheitis appear more ill than adults and are at greater risk of developing airway obstruction

Prevention: For prevention, *Haemophilus influenzae* type B conjugated vaccine is recommended for all pediatric patients

(e) Tuberculosis (TB): TB is caused by bacteria called *Mycobacterium tuberculi (M. tuberculi)*. Bovine TB is a disease caused by similar bacteria called *Mycobacterium bovis (M. bovis)*. Bovine TB mainly affects cattle but can also affect humans. TB is spread from one person to another through the sneezing, coughing etc.

Clinical symptoms of pulmonary TB: fever; night sweats; cough (often chronic); hemoptysis (coughing up bloody sputum); decrease or loss of appetite; weight loss and/or muscle loss; fatigue; chest pain (pain while breathing); shortness of breath; swollen lymph nodes; pneumonitis.

Prevention: A major part of the prevention of TB is to stop the spread of bacteria from one adult to another. This is done by firstly finding the adults who have TB. There is a vaccine, the BCG vaccine, but it is used for children as it doesn't seem to prevent the disease in adults.

2. Lower Respiratory Infections:

(a) Bronchitis and Bronchiolitis: Bronchitis and bronchiolitis involve inflammation of the bronchial tree. Bronchitis is usually preceded by an upper respiratory tract infection or forms part of a clinical syndrome in diseases such as influenza, rubeola, rubella, pertussis, scarlet fever and typhoid fever. Chronic bronchitis with a persistent cough and sputum production appears to be caused by a combination of environmental factors, such as smoking, and bacterial infection with pathogens such as *H. influenzae* and *S. pneumoniae*. Bronchiolitis is a viral respiratory disease of infants and is caused primarily by respiratory virus. Other viruses, including *parainfluenza* viruses, *influenza* viruses and *adenoviruses* (as well as occasionally *M. pneumoniae*) are also known to cause bronchiolitis.

Clinical symptoms: Symptoms of an upper respiratory tract infection with a cough is the typical initial presentation in acute bronchitis. Mucopurulent (secretion of fluid containing mucus and pus) sputum may be present, and moderate temperature elevations occur. Typical findings in chronic bronchitis are an incessant cough and production of large amounts of sputum, particularly in the morning.

Coryza and cough usually precede the onset of bronchiolitis. Fever is common. A deepening cough, increased respiratory rate, and restlessness follow. Retractions of the chest wall, nasal flaring, and grunting are prominent findings. Wheezing or an actual lack of breath sounds may be noted. Respiratory failure and death may result.

Prevention: There are no preventative measures available to treat all of the possible agents that can cause bronchitis.

(b) Pneumonia: Pneumonia is an inflammation of the lung parenchyma.

Bacterial pneumonias: *Streptococcus pneumoniae* is the most common agent of community-acquired acute bacterial pneumonia. *Streptococcus pyogenes* pneumonia is often associated with a hemorrhagic pneumonitis (inflammation of the walls of the alveoli (air sacs) in the lungs) and empyema (collection of pus in the pleural cavity). Community-acquired pneumonias caused by *Staphylococcus aureus* are also uncommon and usually occur after influenza or from staphylococcal bacteremia (presence of bacteria in the blood). Infections due to *Haemophilus influenzae* and *Klebsiella pneumoniae* are more common among patients over 50 years old who have chronic obstructive lung disease or alcoholism. *Mycobacterium tuberculi* can also cause pneumonia. The most common agents of nosocomial pneumonias are aerobic gram-negative bacilli that rarely cause pneumonia in healthy individuals. *Pseudomonas aeruginosa, Escherichia coli, Enterobacter, Proteus,* and *Klebsiella* species are often identified. Less common agents causing pneumonias include *Francisella tularensis*, the agent of tularemia; *Yersinia pestis*, the agent of plague; and *Neisseria meningitidis*, which usually causes meningitis but can be associated with pneumonia, especially among military recruits. *Xanthomonas pseudomallei* cause melioidosis, a chronic pneumonia in Southeast Asia. *Chlamydia* spp noted to cause pneumonitis are *C. trachomatis, C. psittaci* and *C. pneumoniae*. *Chlamydia trachomatis* causes pneumonia in neonates and young infants. *C. psittaci* is a known cause for occupational pneumonitis in bird handlers such as turkey farmers. *Chlamydia pneumoniae* has been associated with outbreaks of pneumonia in military recruits and on college campuses. *Legionella* species, including *L pneumophila,* can cause a wide range of clinical manifestations

Among the fungi, *Cryptococcus neoformans* and *Sporothrix schenckii* are found worldwide, whereas *Blastomyces dermatitidis, Coccidioides immitis, Histoplasma capsulatum* and *Paracoccidioides brasiliensis* have specific geographic distributions. All can cause pneumonias, which are usually chronic and possible clinically inapparent in normal hosts, but are manifested as more serious diseases in immunocompromised patients. Other fungi, such as *Aspergillus* and *Candida* spp, occasionally are responsible for pneumonias in severely ill or immunosuppressed patients and neonates.

Clinical symptoms: The major symptoms or pneumonia are cough, chest pain, fever, shortness of breath and sputum production. Headache, confusion, abdominal pain, nausea, vomiting and diarrhea may be present, depending on the age of the patient and the organisms involved.

Prevention: The pneumococcal vaccine should be given to patients at high risk for developing pneumococcal infections, including the elderly and any patients immunocompromised through disease or medical therapy.

Microbial diseases of the Digestive System: The digestive system consists of the gastrointestinal tract, which includes the oral cavity, pharynx, esophagus, stomach, and intestines, and a number of associated structures and glands such as the teeth, salivary glands, liver, and pancreas. These organs consume food, digest it, absorb nutrients, and eliminate waste that is not absorbed.

(a) Dental caries, or cavities, is a universal microbiological problem. Most cases are caused by *Streptococcus mutans,* which adheres to the tooth enamel and produces glucans, which are a meshwork of glucose molecules. Together with bacteria and debris, glucans make up the dental plaque**.** The bacteria ferment carbohydrates and produce lactic acid, acetic acid, butyric acid, and other acids that damage the enamel. The susceptibility to tooth decay can be lessened by thorough brushing and flossing to remove *S. mutans* and by reducing the consumption of sugar.

(b) Shigellosis is also known as bacillary dysentery**.** It is caused by four species of the Gram-negative rod *Shigella: S. dysenteriae, S. boydii, S. sonnei,* and *S. flexneri*. Most cases occur in young children, and transmission takes place by an oral-fecal route. The disease is highly communicable and is initiated by a low number of bacteria as compared to other infections. The bacteria produce a toxin that causes lesions and inflammation of the intestinal lining and stools streaked with blood and mucus. Antimicrobial therapy is also available with a number of antibiotics, including quinolones.

(c) Salmonellosis refers to a number of foodborne and waterborne infections due to species of *Salmonella*. The organisms are Gram-negative rods and include, *S. enteritidis* and *S. choleraesuis*. They are transmitted by a fecal-oral route, and patients experience extensive diarrhea with fever, abdominal cramps, and nausea. The infection usually limits itself, and antibiotic therapy is not used unless severe complications exist. Chicken, egg, and poultry products are often involved because *Salmonella* strains live in domestic fowl.

(d) Typhoid fever is caused by the Gram-negative, aerobic rod *Salmonella typhi*. The disease is transmitted by contaminated food and water and begins with a high fever lasting several days or weeks. A skin rash called rose spots is associated with the disease. Patients are tired, confused, and delirious, and the mortality rate without antibiotic therapy is high. Intestinal bleeding and wall perforation may occur. Chloramphenicol is used in therapy. These people shed the bacteria in their feces and are a source of infection to other individuals. Effective sanitation practices can prevent the occurrence of the disease.

(e) Cholera, caused by *Vibrio cholerae*, is a disease transmitted primarily by contaminated water. Its exotoxin binds to host cells, and the host epithelial cells secrete large quantities of chloride into the intestinal lumen followed by large amounts of water and sodium and other electrolytes. The primary symptoms of cholera are profuse diarrhea and vomiting of clear fluid. If the severe diarrhea is not treated, it can result in life-threatening dehydration and electrolyte imbalances. The only effective treatment is rehydration accomplished by intravenous and oral rehydrating solutions. Effective sanitation practices can prevent the occurrence of the disease.

(f) Campylobacteriosis is caused by *Campylobacter jejuni*, a curved, Gram-negative rod often transmitted by contaminated milk. Patients experience bloody diarrhea, as well as abdominal pain and fever. Most infections limit themselves, but antibiotic therapy with erythromycin hastens recovery. The common routes of transmission for the disease-causing bacteria are fecal-oral, person-to-person sexual contact, ingestion of contaminated food (generally unpasteurized (raw) milk and undercooked or poorly handled poultry), and waterborne (i.e., through contaminated drinking water). Contact with contaminated poultry, livestock, or household pets, especially puppies, can also cause disease. Prevention methods include Pasteurization of milk and chlorination of drinking water destroys the organisms; Treatment with antibiotics can reduce fecal excretion; Infected health care workers should not provide direct patient care; Separate cutting boards should be used for foods of animal origin and other foods. After preparing raw food of animal origin, all cutting boards and countertops should be carefully cleaned with soap and hot water; Contact with pet saliva and feces should be avoided.

(g) Gastric ulcers disease: In recent years, gastric ulcers have been related to the gram-negative rod *Helicobacter pylori*. This organism survives in the lining of the stomach by producing enzymes to convert urea to ammonia, thereby raising the pH. The most common symptom is a burning sensation or pain in the middle of the abdomen between ther chest and belly button. Typically, the pain will be more intense when the stomach is empty, and it can last for a few minutes to several hours. Effective sanitation practices can prevent the occurrence of the disease.

(h) Staphylococcal food poisoning is caused by toxin-producing strains of *Staphylococcus aureus*. The toxin, an enterotoxin, is produced in food and affects the gastrointestinal tract causing vomiting, diarrhea, and abdominal cramps. The incubation period is a short few hours, and the illness limits itself after a brief but intense period. Fluid replacement may be necessary if severe diarrhea has taken place. Careful handling of foods, especially leftover foods, is paramount in preventing this disease.

(i) Clostridial food poisoning is due to *Clostridium perfringens*, a spore forming and anaerobic rod. This organism produces its toxin in meat, and consumption of contaminated meat leads to mild gastroenteritis, with

diarrhea. The infection is self-limiting and rarely requires antibiotic therapy. *Clostridium botulinum* also is transmitted through contaminated food. The most common symptoms are watery diarrhea and abdominal cramps. Vomiting and fever are unusual. The growth of *C. perfringens* spores can be prevented by most importantly cooking food, especially beef and poultry, thoroughly to the recommended temperatures. Leftover food should be refrigerated to a temperature below 4 °C within two hours of preparation. Large pots of food like soup or stew with meats should be divided in small quantities and covered for refrigeration. Leftovers should be reheated to at least 74 °C before serving.

Microbial diseases of Nervous System:

Bacterial infections that affect the nervous system are serious and can be life-threatening. Fortunately, there are only a few bacterial species commonly associated with neurological infections.

(a) Bacterial Meningitis: is one of the most serious forms of meningitis. Bacteria that cause meningitis often gain access to the CNS through the bloodstream after trauma or as a result of the action of bacterial toxins. Bacteria may also spread from structures in the upper respiratory tract, such as the oropharynx, nasopharynx, sinuses, and middle ear. Patients with head wounds or cochlear implants (an electronic device placed in the inner ear) are also at risk for developing meningitis.

The most common causes of non-neonatal bacterial meningitis are *Neisseria meningitidis*, *Streptococcus pneumoniae*, *Haemophilus influenza*, *Listeria monocytogenes* and *Escherichia coli*. All of these bacterial pathogens are spread from person to person by respiratory secretions. Without appropriate systemic antibacterial therapy, the case-fatality rate can be as high as 70 %, and 20 % of those survivors may be left with irreversible nerve damage or tissue destruction, resulting in hearing loss, neurologic disability, or loss of a limb.

Characteristics of specific forms of bacterial meningitis are detailed in the subsections that follow.

Meningococcal Meningitis: is a serious infection caused by the gram-negative coccus *N. meningitidis*. In some cases, death can occur within a few hours of the onset of symptoms. Nonfatal cases can result in irreversible nerve damage, resulting in hearing loss and brain damage, or amputation of extremities because of tissue necrosis.

A unique sign of meningococcal meningitis is the formation of a petechial rash on the skin or mucous membranes, characterized by tiny, red, flat, hemorrhagic lesions. This rash, which appears soon after disease onset, is a response to LOS endotoxin and adherence virulence factors that disrupt the endothelial cells of capillaries and small veins in the skin.

Pneumococcal meningitis is caused by the encapsulated gram-positive bacterium *S. pneumoniae* (pneumococcus, also called strep pneumo). This organism is commonly found in the **microbiota** of the pharynx of 30–70% of young children, depending on the sampling method, while *S. pneumoniae* can be found in fewer than 5% of healthy adults. Although it is often present without disease symptoms, this microbe can cross the blood-brain barrier in susceptible individuals.

Neonatal Meningitis: *Streptococcus agalactiae*, Group B *Streptococcus* (GBS), is an encapsulated gram-positive bacterium that is the most common cause of neonatal meningitis, a term that refers to meningitis occurring in babies up to 3 months of age. Early onset disease is defined as occurring in infants up to 7 days old. The infant initially becomes infected by *S. agalactiae* during childbirth, when the bacteria may be transferred from the mother's birth canal.

Signs and symptoms of early onset disease include temperature instability, apnea (cessation of breathing), bradycardia (slow heart rate), hypotension, difficulty feeding, irritability, and limpness. When asleep, the baby may be difficult to wake up. Symptoms of late-onset disease are more likely to include seizures, bulging fontanel (soft spot), stiff neck, hemiparesis (weakness on one side of the body), and opisthotonos (rigid body with arched back and head thrown backward).

(b) Botulism and Tetanus: Endospores of *Clostridium* spp. are widespread in nature, commonly found in soil, water, feces, sewage, and marine sediments. *Clostridium* spp. produce more types of protein exotoxins than any

other bacterial genus, including two exotoxins: botulinum neurotoxin (BoNT) and tetanus neurotoxin (TeNT). These two toxins have lethal doses of 0.2–10 ng per kg body weight.

BoNT is produced by unique strains of *C. butyricum*, and *C. baratii*; however, it is primarily associated with *C. botulinum* and the condition of botulism. TeNT, which causes tetanus, is only produced by *C. tetani*. These powerful neural exotoxins are the primary virulence factors for these pathogens.

If BoNT is absorbed through the gastrointestinal tract, early symptoms of botulism include blurred vision, drooping eyelids, difficulty swallowing, abdominal cramps, nausea, vomiting, constipation, or possibly diarrhea. This is followed by progressive flaccid paralysis, a gradual weakening and loss of control over the muscles. In infants, notable signs of botulism include weak cry, decreased ability to suckle, and hypotonia (limpness of head or body). Eventually, botulism ends in death from respiratory failure caused by the progressive paralysis of the muscles of the upper airway, diaphragm, and chest.

Tetanus is a noncommunicable disease characterized by uncontrollable muscle spasms (contractions) caused by the action of TeNT. Neonatal tetanus typically occurs when the stump of the umbilical cord is contaminated with spores of *C. tetani* after delivery. Symptoms include uncontrollable, sudden muscle spasms that are powerful enough to cause tendons to rupture and bones to fracture. Spasms in the muscles in the neck, back, and legs may cause the body to form a rigid, stiff arch, a posture called opisthotonos. Spasms in the larynx, diaphragm, and muscles of the chest restrict the patient's ability to swallow and breathe, eventually leading to death by asphyxiation (insufficient supply of oxygen).

(c) *Haemophilus influenzae* Type b: *H. influenzae* can be found in the throats of healthy individuals, including infants and young children. By five years of age, most children have developed immunity to this microbe. Infants older than 2 months of age, however, do not produce a sufficient protective antibody response and are susceptible to serious disease. The profound inflammation caused by these microbes can result in early symptoms that include severe headache, fever, confusion, nausea, vomiting, photophobia, and stiff neck. Systemic inflammatory responses associated with some types of bacterial meningitis can lead to hemorrhaging and purpuric lesions on skin, followed by even more severe conditions that include shock, convulsions, coma, and death—in some cases, in the span of just a few hours.

Fungal infections of the nervous system, called neuromycoses**,** are rare in healthy individuals. However, neuromycoses can be devastating in immunocompromised or elderly patients.

(d) Cryptococcocal Meningitis: *Cryptococcus neoformans* is a fungal pathogen that can cause meningitis. This yeast is commonly found in soils and is particularly associated with pigeon droppings. It has a thick capsule that serves as an important virulence factor, inhibiting clearance by phagocytosis. Most *C. neoformans* cases result in subclinical respiratory infections that, in healthy individuals, generally resolve spontaneously with no long-term consequences.

The symptoms of CM usually come on slowly. Within a few days to a few weeks of contact, an infected person may develop the following symptoms: headache, nausea, vomiting, mental changes, including confusion, hallucinations, and personality changes, lethargy, sensitivity to light. In some cases, the infected person may experience a stiff neck and fever. If left untreated, CM may lead to more serious symptoms, such as: brain damage, coma, hearing loss, hydrocephalus (which is also called "water on the brain).

(e) Amoebic Meningitis: Primary amoebic meningoencephalitis (PAM) is caused by *Naegleria fowleri*. This amoeboflagellate is commonly found free-living in soils and water. Individuals are typically infected by the amoeba while swimming in warm bodies of freshwater such as rivers, lakes, and hot springs. The pathogenic trophozoite infects the brain by initially entering through nasal passages to the sinuses; it then moves down olfactory nerve fibers to penetrate the submucosal nervous plexus, invades the cribriform plate, and reaches the subarachnoid space. The subarachnoid space is highly vascularized and is a route of dissemination of trophozoites to other areas of the CNS, including the brain. Inflammation and destruction of gray matter leads to severe headaches and fever. Within days, confusion and convulsions occur and quickly progress to seizures, coma, and death. The progression can be very rapid, and the disease is often not diagnosed until autopsy.

(f) Granulomatous Amoebic Encephalitis (GAE): *Acanthamoeba* sp and *Balamuthia mandrillaris* are free-living amoebae found in many bodies of fresh water responsible for GAE in severe cases. The microbe is thought to enter through either the nasal sinuses or breaks in the skin and can invade the CNS. There, the infections lead to inflammation, formation of lesions, and development of typical neurological symptoms of encephalitis. Symptoms of GAE includes the headaches; stiff neck; nausea; vomiting; tiredness; confusion; lack of attention to people and surroundings; loss of balance; loss of bodily control; seizures; hallucinations

(g) Human African Trypanosomiasis (African sleeping sickness): is a serious disease endemic to two distinct regions in Africa. It is caused by the insect-borne hemoflagellate *Trypanosoma brucei*. The subspecies *Trypanosoma brucei rhodesiense* causes East African trypanosomiasis (EAT) and another subspecies, *Trypanosoma brucei gambiense* causes West African trypanosomiasis (WAT). *T. brucei* is primarily transmitted to humans by the bite of the tsetse fly (*Glossina* spp.). Clinical symptoms can be used to recognize the early signs of African trypanosomiasis. These include the formation of a chancre (a painless ulcer, particularly one that develops on the genitals in venereal disease) at the site of infection, Winterbottom's sign **(**refers to the enlargement of lymph nodes on the back of the neck often indicative of cerebral infections**),** anemia, endocrine, cardiac, and kidney dysfunctions. Other neurological symptoms include confusion, tremor, general muscle weakness, hemiparesis, and paralysis of a limb.

Microbial diseases of Skin: The following are four different types of skin infections:
Bacterial skin infections often begin as small, red bumps that slowly increase in size. Some bacterial infections are mild and easily treated with topical antibiotics, but other infections require an oral antibiotic. Different types of bacterial skin infections include:
(a) Impetigo: is caused by a *Staphylococcus aureus* or *Streptococcus pyogenes* bacterial infection on the outer layers of skin, the epidermis. The face, arms, and legs are the skin areas most often affected. Anyone can get impetigo, but it's the most common bacterial skin infection among children, affecting mostly 2 to 5 year olds. In fact, it accounts for about 10 percent of skin problems seen in pediatric clinics. The infection most often begins in minor cuts, insect bites, or a rash such as eczema any place there is broken skin. But it can also occur on healthy skin. It's called *primary* impetigo when it infects healthy skin and *secondary* impetigo when it occurs in broken skin.
Symptoms: Reddish spots on the skin, often clustered around the nose and lips, are the first sign of the most common type of impetigo. The sores quickly grow into blisters, ooze and burst, and then form a yellowish crust. The crust is often described as honey-colored. The clusters of blisters may expand to cover more of skin. The sores are unsightly, itchy, and occasionally painful. After the crust phase, they leave red marks that fade without leaving scars. Infants often have a less common type of impetigo, with larger blisters around the diaper area or in skin folds. These fluid-filled blisters soon burst, leaving a scaly rim called a collarette. Impetigo can be uncomfortable. Occasionally, it may involve swollen glands in the area of the outbreak. Fever and swollen glands can occur in more severe cases.
Prevention:

- Regular bathing and frequent handwashing can cut down on skin bacteria.
- Cover any skin wounds or insect bites to protect the area.
- Keep nails clipped and clean.
- Wash everything that comes in contact with the impetigo sores in hot water and some laundry bleach.
- Change bed linens, towels, and clothing every day, until the sores are no longer contagious.
- Clean and disinfect surfaces, equipment, and toys that may have come in contact with impetigo.
- Don't share any personal items with someone who has impetigo.

(b) Leprosy: is a chronic disease caused by a bacillus, *Mycobacterium leprae* (*M. laprae*). *M. leprae* multiplies very slowly and the incubation period of the disease is considered to be about five years.

Transmission: Leprosy is transmitted by air through droplets from the nose and mouth, during close and frequent contacts with untreated cases. Leprosy is one of the least infectious diseases, because: Over 99 % of the population has adequate natural immunity; Over 85 % of the clinical cases are non-infectious, and an infectious case is rendered non-infectious within one week, most often after the very first dose of treatment.
Symptoms: Leprosy mainly affects the skin and peripheral nerves; if left untreated, it can lead to progressive and permanent damage of nerves, leading to loss of sensation and sweating in the extremities and paralysis of muscles in the hands, feet and face; the disease is classified as paucibacillary (pb) or multibacillary (mb), depending on the bacillary load; pb leprosy is a milder disease characterized by few (up to five) skin lesions (pale or reddish), whereas mb is associated with multiple (more than five) skin lesions, nodules, plaques, thickened dermis or skin infiltration.
Prevention: The prevention of leprosy ultimately lies in the early diagnosis and treatment of those individuals suspected or diagnosed as having leprosy, thereby preventing further transmission of the disease to others.

(c) Staphylococcal scalded skin syndrome (SSSS): is a serious skin infection caused by the bacterium *Staphylococcus aureus*. This bacterium produces an exfoliative toxin that causes the outer layers of skin to blister and peel, as if they've been doused with a hot liquid. SSSS also called Ritter's disease, affecting up to 56 people out of 1,00,000. It's most common in children under 6.
Transmission: The staphylococcus bacteria are transferred from person to person by sharing towels or by droplets of coughing.
Symptoms: Early signs of SSSS usually begin with the hallmark symptoms of an infection: Fever; irritability; fatigue; chills; weakness; lack of appetite; conjunctivitis (an inflammation or infection of the clear lining that covers the white portion of the eyeball), red, tender skin, either limited to the entry point of the bacteria or widespread; easily broken blisters; peeling skin, which can come off in large sheets
Prevention: In order to prevent SSSS, several facts are to be considered which includes following points

i. Antibacterial/ antiseptic soap are to be used in hand wash.
ii. Clean towel or fresh clothing is to be used to dry the body or hands.
iii. The linens and clothes are to be washed in hot water.
iv. Antibacterial products are to be used in cleaning wall.
v. The fingernails must be short to avoid any contamination.
vi. Schools and childcare centres are to be avoided when the infection is in contagious form.
vii. The personal hygiene items should not be shared.
viii. Washing hands before touching any damaged or broken skin.
ix. In cases of mild infections, bacterial colonizing can be prevented in the nostril and under the fingernails with antibiotic creams like Fusidic Acid or by using petroleum jelly several times daily, for a week of each month.

Viral skin infections are caused by a virus. These infections range from mild to severe. Different types of viral infections include:
(d) Shingles (herpes zoster): Shingles an infection caused by the *Varicella-zoster* virus, which is the same virus that causes chickenpox. Even after the chickenpox infection is over, the virus may live in the nervous system for years before reactivating as shingles. Shingles may also be referred to as herpes zoster. Most cases of shingles clear up within two to three weeks.
Transmission: Shingles is contagious.
Symptoms: The first symptoms of shingles are usually pain and burning. The pain is usually on one side of the body and occurs in small patches. A red rash typically follows. Rash characteristics include: red patches; fluid-filled blisters that break easily; a rash that wraps around from the spine to the torso; a rash on the face and ears; itching. Some people experience symptoms beyond pain and rash with shingles. These symptoms may include: a fever; chills; a headache; fatigue; muscle weakness
Prevention: All children should receive two doses of the chickenpox vaccine, also known as a varicella immunization. Adults who've never had chickenpox and who are 60 years old are recommended to take vaccine.

(e) Chickenpox: Chickenpox is caused by the *Varicella zoster virus. Varicella* has an incubation period of 10-21 days. Chickenpox is highly contagious. The infection spreads in a similar way to colds and flu.
Transmission: It is transmitted from person to person by direct contact (touching the rash), droplet or air born spread (coughing and sneezing) of vesicle fluid or secretions of the respiratory tract of cases or of vesicle fluid of patients with herpes Zoster.
Symptoms: Before the rash appears, there will be: malaise (a general feeling of being unwell); fever, which is usually worse in adults than children; aching muscles; loss of appetite, in some cases, a feeling of nausea. After the rash appears, there will be: Small, red, and itchy spots on the face, limbs, chest, and stomach; Blisters**;** Clouding; Healing; During the whole cycle, new waves of spots can appear in such cases, the patient might have different clusters of spots at varying stages of itchiness, dryness, and crustiness.
Prevention: A vaccine is available for varicella. For children, 2 doses of the varicella vaccine are given, one at 12 to 15 months and one at age 4 to 6 years. These are 90 % effective at preventing chickenpox.

These types of skin infections are caused by a fungus and are most likely to develop in damp areas of the body, such as the feet or armpit. Different types of fungal infections:
(f) Athlete's foot: Athlete's foot occurs when the *Tinea* fungus grows on the feet.
Transmission: The fungus can b transmitted through direct contact with an infected person, or by touching surfaces contaminated with the fungus. The fungus thrives in warm, moist environments. It's commonly found in showers, on locker room floors, and around swimming pools.
Symptoms: There are many possible symptoms of athlete's foot, which include: itching, stinging, and burning between the toes; itching, stinging, and burning on the soles of the feet; blisters on the feet that itch; cracking and peeling skin on the feet, most commonly between the toes and on the soles; dry skin on the soles or sides of the feet; raw skin on the feet; discoloured, thick, and crumbly toenails; toenails that pull away from the nail bed
Prevention: There are several things that can help to prevent athlete's foot infections. These include:

- Washing of feet with soap and water every day and drying them thoroughly, especially between the toes.
  - To kill the fungus, wash in 60 ℃ water or higher. Combining washing with OTC anti-fungal recommendations should treat most cases of athlete's foot.
- Use of antifungal powder on feet every day.
- Don't share socks, shoes, or towels with others.
- Wear sandals in public showers, around public swimming pools, and in other public places.
- Wear socks made out of breathable fibers, such as cotton or wool, or made out of synthetic fibers that wick moisture away from the skin.
- Wearing shoes made of breathable materials.

(g) Ringworm: Ringworm, also known as dermatophytosis or tinea, is a fungal infection of the skin. The name "ringworm" is a misnomer, since the infection is caused by a fungus, not a worm. Scientific names for the most common of the dermatophyte fungi that cause ringworm include *Trichophyton rubrum*, *Trichophyton tonsurans*, *Trichophyton interdigitale*, and/or *Trichophyton mentagrophytes*, *Microsporum canis*, and *Epidermophyton floccosum*.
Transmission: Ringworm infection can affect both humans and animals. The infection initially presents with red patches on affected areas of the skin and later spreads to other parts of the body. The infection may affect the skin of the scalp, feet, groin, beard, or other areas.

Symptoms: Ringworm of the bearded area of the face and neck, with swelling and marked crusting, is often accompanied by itching, sometimes causing the hair to break off. In the days when men went to the barber daily for a shave, *Tinea barbae* was called barber's itch. Ringworm of the scalp commonly affects children, mostly in late childhood or adolescence. This condition may spread in schools. *Tinea capitis* appears as scalp scaling that is associated with bald spots (in contrast to seborrhea or dandruff, for instance, which do not cause hair loss).

Prevention: Practicing healthy and hygienic behaviours. Many infections come from contact with animals and lack of proper hygiene. Tips to avoid ringworm include: wash hands after interacting with an animal; disinfect and clean pet living areas; avoid people or animals with ringworm; shower and shampoo the hair regularly; wear shoes if showering in community areas; avoid sharing personal items like clothing or hairbrushes with people who might have ringworm; keep the feet clean and dry.

Different types of parasitic skin infections include:

(h) Lice: are tiny insects called parasites that spread by personal contact, as well as by sharing belongings. Children are particularly likely to catch and spread lice. There are three main types of lice. They all come from the same parasite family, but they're each a different species: Head lice a present on the scalp, neck, and ears; Body lice start out on clothing or in beds. Pubic lice are also called crabs.

Symptoms: In addition to intense itching, lice can cause other symptoms, such as: a tickling feeling of something moving on the head, hair, or body; sores that develop from scratching itches; irritability; difficulty sleeping; red bumps on the head, neck, shoulders, or pubic area; the appearance of lice eggs, or small white objects in hair.

Prevention: Avoid sharing personal belongings such as hairbrushes, hairclips, combs, and hats. Launder clothes and sheets regularly

(i) Scabies: is a skin infestation caused by a mite known as the *Sarcoptes scabiei*. Untreated, these microscopic mites can live on skin for months. They reproduce on the surface of skin and then burrow into it and lay eggs.

Transmission: It's a highly contagious condition that can easily be passed from one person to another through direct skin contact. It may also be transmitted through infested clothing or bedding.

Symptoms: The hallmark symptoms of scabies include a rash and intense itching that gets worse at night.

Prevention: The best way to prevent getting scabies is to avoid direct skin-to-skin contact with a person known to have scabies.

Microbial Diseases of Urinary Tract: A urinary tract infection (UTI) is an infection that affects part of the urinary tract. UTIs include infections of the urethra, bladder, and kidneys. Bacteria are the most common causes of UTIs, especially in the urethra and bladder. In sexually active women the most common cause of urinary tract infection is from *E.coli* and *Staphylococcus saprophyticus*

Categories of UTI:

(i) Uncomplicated UTIs: In uncomplicated cases, a diagnosis may be made and treatment given based on symptoms alone without further laboratory confirmation, and treatment involves a short course of antibiotics such as nitrofurantoin or trimethoprim / sulfamethoxazole.

(ii) Complicated UTIs: In complicated cases, it may be useful to confirm the diagnosis via urinalysis, looking for the presence of urinary nitrites, white blood cells (leukocytes), or leukocyte esterase. Another test, urine microscopy, looks for the presence of red blood cells, white blood cells, or bacteria. A longer course or intravenous antibiotics may be needed. If symptoms do not improved in two or three days, further diagnostic testing may be needed. Phenazopyridine may help with symptoms.

(iii) Lower UTI: Lower urinary tract infection is also referred to as a bladder infection. The most common symptoms are burning with urination and having to urinate frequently (or an urge to urinate) in the absence of vaginal discharge and significant pain. These symptoms may vary from mild to severe and in healthy women last an average of six days. some pain above the pubic bone or in the lower back may be present.

(iv) Upper UTI: People experiencing an upper urinary tract infection, or pyelonephritis, may experience flank pain, fever, or nausea and vomiting in addition to the classic symptoms of a lower urinary tract infection. Rarely the urine may appear bloody or contain visible pus in the urine.

(a) Cystitis: Cystitis is a urinary bladder inflammation that can result from any one of a number of distinct syndromes.

Gram-negative bacteria such as *Escherichia coli* (most commonly), *Proteus vulgaris*, *Pseudomonas aeruginosa*, and *Klebsiella pneumonia* cause most bladder infections. Gram-positive pathogens associated with cystitis include the coagulase-negative *Staphylococcus saprophyticus*, *Enterococcus faecalis*, and *Streptococcus agalactiae*.

Signs and symptoms: pressure in the lower pelvis, painful urination (dysuria), frequent urination (polyuria) or urgent need to urinate (urinary urgency), need to urinate at night (nocturia), urine that contains traces of blood (haematuria), dark, cloudy or strong-smelling urine, pain above the pubic bone, or in the lower back or abdomen, feeling unwell, weak, or feverish

Subtypes: There are several medically distinct types of cystitis, each having a unique etiology and therapeutic approach:

- Traumatic cystitis is probably the most common form of cystitis in the female. It is due to bruising of the bladder, usually by abnormally forceful sexual intercourse. This is often followed by bacterial cystitis, frequently by coliform bacteria being transferred from the bowel through the urethra into the bladder.
- Interstitial cystitis (IC) is considered more of an injury to the bladder resulting in constant irritation and rarely involves the presence of infection. IC patients are often misdiagnosed with UTI/cystitis for years before they are told that their urine cultures are negative. The cause of IC is unknown, although some suspect it may be autoimmune where the immune system attacks the bladder.
- Eosinophilic cystitis (EC) is a rare form of cystitis that is diagnosed via biopsy. In these cases, the bladder wall is infiltrated with a high number of eosinophils. The cause of EC may be attributed to infection by *Schistosoma haematobium* or by certain medications in afflicted children.
- Hemorrhagic cystitis can occur as a side effect of cyclophosphamide, ifosfamide, and radiation therapy. Radiation cystitis, one form of hemorrhagic cystitis is a rare consequence of patients undergoing radiation therapy for the treatment of cancer. Several adenovirus serotypes have been associated with an acute, self-limited hemorrhagic cystitis, which occurs primarily in boys.
- Cystitis cystica is a chronic cystitis glandularis accompanied by the formation of cysts. This disease can cause chronic urinary tract infections. It appears as small cysts filled with fluid and lined by one or more layers of epithelial cells. These are due to hydropic degeneration in center of Brunn's nests.

(b) Kidney Infections (Pyelonephritis and Glomerulonephritis): Pyelonephritis, an inflammation of the kidney, can be caused by bacteria that have spread from other parts of the urinary tract (such as the bladder). In addition, pyelonephritis can develop from bacteria that travel through the bloodstream to the kidney. When the infection spreads from the lower urinary tract, the causative agents are typically fecal bacteria such as *E. coli*.

Signs and symptoms: Back pain (due to the location of the kidneys), fever, and nausea or vomiting. Gross hematuria (visible blood in the urine) occurs in 30–40 % of women but is rare in men. The infection can become serious, potentially leading to bacteremia and systemic effects that can become life-threatening. Scarring of the kidney can occur and persist after the infection has cleared, which may lead to dysfunction.

Diagnosis of pyelonephritis is made using microscopic examination of urine, culture of urine, testing for leukocyte esterase and nitrite levels, and examination of the urine for blood or protein. It is also important to use blood cultures to evaluate the spread of the pathogen into the bloodstream. Imaging of the kidneys may be performed in high-risk patients with diabetes or immunosuppression, the elderly, patients with previous renal damage, or to rule out an obstruction in the kidney.

Glomerulonephritis occurs when the glomeruli of the nephrons are damaged from inflammation. Whereas pyelonephritis is usually acute, glomerulonephritis may be acute or chronic. The well-characterized mechanism of glomerulonephritis is the post-streptococcal sequelae associated with *Streptococcus pyogenes* that affect throat and skin. Although *S. pyogenes* does not directly infect the glomeruli of the kidney, immune complexes that form in blood between *S. pyogenes* antigens and antibodies lodge in the capillary endothelial cell junctions of the glomeruli and trigger a damaging inflammatory response. Glomerulonephritis can also occur in patients

with bacterial endocarditis (infection and inflammation of heart tissue); however, it is currently unknown whether glomerulonephritis associated with endocarditis is also immune-mediated.

(c) Leptospirosis: Leptospirosis is a rare and severe infection caused by *Leptospira* bacteria and usually transmitted to people from animals.

Transmission: The infection is commonly transmitted to humans by allowing water that has been contaminated by animal urine to come in contact with unhealed breaks in the skin, eyes, or mucous membranes. *Leptospira* spp. are found widely in animals such as dogs, horses, cattle, pigs, and rodents, and are excreted in their urine. Humans generally become infected by coming in contact with contaminated soil or water, often while swimming or during flooding; infection can also occur through contact with body fluids containing the bacteria. The bacteria may enter the body through mucous membranes, skin injuries, or by ingestion.

Symptoms: Symptoms can range from none to mild such as headaches, muscle pains, and fevers; to severe with bleeding from the lungs or meningitis. If the infection causes the person to turn yellow, have kidney failure and bleeding, pulmonary haemorrhage syndrome.

Diagnosis of leptospirosis is generally made using serologic testing, polymerase chain reaction (PCR), enzyme-linked immunosorbent assay (ELISA), slide agglutination, and indirect immunofluorescence tests.

Prevention: A number of measures have not been confirmed to affect UTI frequency including: urinating immediately after intercourse, the type of underwear used, personal hygiene methods used after urinating or defecating.

Microbial diseases of Eye: A small number of bacteria are normally present in the conjunctiva. These include: *Chlamydia trachomatis*, *Chlamydophila pneumoniae*, *Haemophilus aegyptius*, *Haemophilus influenzae*, *Moraxella* spp, *Neisseria* spp, *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Streptococcus viridians*. *Staphylococcus epidermidis* and certain coryneforms such as *Corynebacterium and Propionibacterium acnes* are dominant. *Staphylococcus aureus*, *Streptococci*, *Haemophilus* sp. and *Neisseria* sp. sometimes occur.

(a) Conjunctivitis: Conjunctivitis, also called pink eye or Madras eye, is inflammation of the conjunctiva, which consists of the outermost layer of the eye and the inner surface of the eyelids. Conjunctivitis most commonly caused by a viral infection or, less commonly, a bacterial infection, or by an allergic reaction. Acute bacterial conjunctivitis is primary due to *Staphylococcus aureus, Streptococcus pneumoniae*, and *Haemophilus influenzae*. Other pathogens responsible for acute disease are *Pseudomonas aeruginosa, Moraxella lacunata, Streptococcus viridans* and *Proteus mirabilis*

Symptoms: An inflamed, red eye (hyperaemia), irritation (chemosis), and watering (epiphora) of the eyes

Bacterial conjunctivitis due to common pyogenic (pus-producing) bacteria causes marked grittiness/irritation and a stringy, opaque, greyish or yellowish mucopurulent discharge that may cause the lids to stick together, especially after sleep; Severe crusting of the infected eye and the surrounding skin.

Corynebacterium diphtheriae causes membrane formation in conjunctiva of non immunized children. Bacterial conjunctivitis usually resolves without treatment. *Chlamydia conjunctivitis* or *trachoma* (caused by *Chlamydia trachomatis*) was once the most important cause of blindness worldwide. The infection can be spread from eye to eye by fingers, shared towels or cloths, coughing and sneezing, and by eye-seeking flies. Newborns can also develop *chlamydia* eye infection through childbirth. *Chlamydia* can affect infants by causing spontaneous abortion, premature birth, and conjunctivitis, which may lead to blindness and pneumonia. Conjunctivitis due to *chlamydia* typically occurs one week after birth (compared with chemical causes (within hours) or gonorrhea (2–5 days).

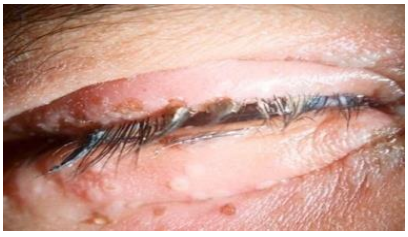
Conjunctivitis

Keratitis

(b) Keratitis: Keratitis is a condition in which the eye's cornea, the front part of the eye, becomes inflamed. The condition is often marked by moderate to intense pain and usually involves impaired eyesight. Superficial keratitis involves the superficial layers (i.e. the epithelium) of the cornea. After healing, this form of keratitis does not generally leave a scar. Deep keratitis involves deeper layers of the cornea (i.e. the epithelium, Bowman's membrane and often stroma), and the natural course leaves a scar upon healing that impairs vision if it occurs on or near the visual axis. This can be reduced or avoided with the use of topical corticosteroid eyedrops.

Keratitis has multiple causes. Bacterial infection of the cornea can follow from an injury or from result from wearing contact lenses. The bacteria involved are *Staphylococcus aureus* and, for contact lens wearers, *Pseudomonas aeruginosa*. *Pseudomonas aeruginosa* contains enzymes that can digest the cornea.
Treatment depends on the cause of the keratitis. Infectious keratitis can progress rapidly, and generally requires urgent antibacterial, antifungal, or antiviral therapy to eliminate the pathogen. Treatment is usually carried out by an ophthalmologist and can involve prescription eye medications, systemic medication, or even intravenous therapy.

(c) Herpes Simplex Virus: Herpetic simplex keratitis is a form of keratitis caused by recurrent herpes simplex virus in cornea. Herpes simplex virus (HSV) infection is very common in humans. Primary infection most commonly manifests as blepharoconjunctivitis i.e. infection of lids and conjunctiva that heals without scarring. Lid vesicles and conjunctivitis are seen in primary infection. Corneal involvement is rarely seen in primary infection. Recurrent herpes of the eye in turn is caused by reactivation of the virus in a latently infected sensory ganglion, transport of the virus down the nerve axon to sensory nerve endings, and subsequent infection of ocular surface.



Herpes simplex blepharitis

(d) Cytomegalovirus Retinitis: Cytomegalovirus retinitis, also known as CMV retinitis, is an inflammation of the retina of the eye that can lead to blindness. Caused by human *Cytomegalovirus*, it occurs predominantly in people whose immune system has been compromised.

(e) *Acanthamoeba:* *Acanthamoeba* is a microscopic, free-living ameba (single-celled living organism) commonly found in the environment that can cause rare, but severe, eye illness. *Acanthamoeba* causes three main types of illness involving the eye (Acanthamoeba keratitis), the brain and spinal cord (Granulomatous Encephalitis), and infections that can spread throughout the entire body (disseminated infection).

(f) Toxoplasmosis: A single-celled parasite called *Toxoplasma gondii* causes a disease known as toxoplasmosis.

Signs and symptoms of ocular toxoplasmosis can include reduced vision, blurred vision, pain (often with bright light), redness of the eye, and sometimes tearing. Whether or not medication is recommended depends on the size of the eye lesion, the location, and the characteristics of the lesion (acute active, versus chronic not progressing).

Prevention:

- Hand-washing is extremely important in preventing the spread of organisms that can cause infection.
- Cosmetics may be a source of recurrent infection.

Sexually Transmitted Diseases: Sexually transmitted diseases *(*STDs*)* are infections that are passed from one person to another through sexual contact. The causes of STDs are bacteria, parasites, yeast, and viruses. Some of the bacterial STDs are curable through treatment with antibiotics.

Bacterial STD List:

(a) Chlamydia: Chlamydia is a disease caused by the bacteria *Chlamydia trachomatis*. It is commonly sexually transmitted from one person to other. Chlamydia can infect the male and female reproductive parts, urethra, eye, or throat. It can cause serious, permanent damage to a woman's reproductive system.

Women with symptoms may notice: An abnormal vaginal discharge and a burning sensation when urinating.

Symptoms in men can include: A discharge from their penis, a burning sensation when urinating and pain and swelling in one or both testicles (although this is less common).

Men and women can also get infected with chlamydia in their rectum. This happens either by having receptive anal sex, or by spread from another infected site (such as the vagina). While these infections often cause no symptoms, they can cause rectal pain; discharge; bleeding.

(b) Gonorrhea: Gonorrhea is caused by the bacteria *Neisseria gonorrhoeae*. The infection can be spread by contact with the mouth, vagina, penis, or anus. A pregnant woman with gonorrhea can give the infection to her baby during childbirth.

Symptoms in women can include: Painful or burning sensation when urinating; Increased vaginal discharge; Vaginal bleeding between periods. Rectal infections may either cause no symptoms or cause symptoms in both men and women that may include: discharge; anal itching; soreness; bleeding; painful bowel movements.

(c) Syphilis: Syphilis is a sexually transmitted infection (STI) caused by the bacterium *Treponema pallidum*. Syphilis is passed from person to person through direct contact with a syphilis sore through vaginal, anal, oral sex, rectum, on the lips, or in the mouth. Syphilis can spread from an infected mother to her unborn baby.

Syphilis is divided into stages (primary, secondary, latent, and tertiary), with different signs and symptoms associated with each stage. A person with primary syphilis generally has a sore or sores at the original site of infection. These sores usually occur on or around the genitals, around the anus or in the rectum, or in or around the mouth. These sores are usually (but not always) firm, round, and painless.

The signs and symptoms of primary and secondary syphilis can be mild, and they might not be noticed. During the latent stage, there are no signs or symptoms. Symptoms of secondary syphilis include skin rash, swollen lymph nodes, and fever. Tertiary syphilis is associated with severe medical problems. It can affect the heart, brain, and other organs of the body.

(d) Chancroid: Chancroid is caused by a type of bacteria called *Haemophilus ducreyi*. It is almost always spread through sexual contact. Uncircumcised men are at much higher risk than circumcised men for getting chancroid from an infected partner.

(e) Lymphogranuloma Venereum (LGV): Lymphogranuloma Venereum (LGV) is a chronic (long-term) infection of the lymphatic system caused by three different types of the bacterium *Chlamydia trachomatis*.

(f) Pelvic Inflammatory Disease (PID): Pelvic Inflammatory Disease (PID) occurs when bacteria moves from the vagina or cervix into the uterus, fallopian tubes, ovaries, or pelvis. Most cases of PID are due to the bacteria that causes chlamydia and gonorrhea.

(g) *Mycoplasma Genitalium*: is a bacterium that can infect the urethra, cervix, throat and anus. It is often associated with bacterial vaginosis (BV) and pelvic inflammatory disease (PID) in women, and is a common cause of non-gonococcal urethritis in men. It has only recently been identified as a sexually transmitted infection (STI).
It is spread through vaginal, anal or oral sex. It can also be transmitted by sex toys and hands and fingers if they have been in contact with an infected person's genitals or anus.

Fungal STD List:

(a) Candidiasis: Candidiasis is an infection caused by a yeast (a type of fungus) called *Candida*. *Candida* normally lives inside the body (in places such as the mouth, throat, gut, and vagina) and on skin without causing any problems. Sometimes *Candida* can multiply and cause an infection if the environment inside the vagina changes in a way that encourages its growth. This can happen because of hormones, medicines, or changes in the immune system. Candidiasis in the vagina is commonly called a "vaginal yeast infection." Other names for this infection are vaginal candidiasis, vulvovaginal candidiasis, or candidal vaginitis. Symptoms of vaginal candidiasis include: Vaginal itching or soreness; Pain during sexual intercourse; Pain or discomfort when urinating; Abnormal vaginal discharge. Although most vaginal candidiasis is mild, some women can develop severe infections involving redness, swelling, and cracks in the wall of the vagina.

Parasite STD List:

(a) Trichomoniasis: Trichomoniasis (or "trich") is a very common sexually transmitted disease (STD) that is caused by infection with a protozoan parasite called *Trichomonas vaginalis*. Trichomoniasis is spread through sexual activity. It needs a warm damp environment to live, so it cannot survive on toilet seats. It can, however, thrive in the vagina, urethra, or bladder. It can also be spread at birth from an infected mother to her baby.
Symptoms may include the following: Bad smelling discharge or frothy green discharge from the vagina; vaginal itching or redness; painful intercourse; lower abdominal discomfort; urge to urinate more often.
Most men have no symptoms, but may notice: pain during urination or ejaculation; urge to urinate often; discharge from the penis.

Viral STD List:

(a) Herpes simplex virus (HSV): Infection with the *herpes simplex* virus, commonly known as herpes, can be due to either herpes simplex virus type 1 (HSV-1) or herpes simplex virus type 2 (HSV-2). HSV-1 is mainly transmitted by oral to oral contact to cause infection in or around the mouth (oral herpes). HSV-2 is almost exclusively sexually transmitted, causing infection in the genital or anal area (genital herpes). However, HSV-1 can also be transmitted to the genital area through oral-genital contact to cause genital herpes. In rare circumstances, HSV-1 infection can be transmitted from a mother with genital HSV-1 infection to her infant during delivery.

Both oral herpes infections and genital herpes infections are mostly asymptomatic but can cause mild symptoms or painful blisters or ulcers at the site of infection. Symptoms can appear days, weeks or months after infection. Subtle early warning signs include tingling, itching or pain in the infected area that may be followed by blisters that break and become painful ulcers. A typical episode lasts for 7-10 days from the first symptoms to the time the ulcers heal. The first episode of symptoms is usually the longest and the most painful. Recurrent episodes are usually milder and clear up more quickly. HSV1 tends to be associated with less severe and less frequent recurrences compared to HSV2.

(b) Human Immunodeficiency Virus (HIV): The Human Immunodeficiency Virus (HIV) targets the immune system and weakens people's defence systems against infections and some types of cancer. As the virus destroys

and impairs the function of immune cells, infected individuals gradually become immunodeficient. Immune function is typically measured by CD4 cell count. The most advanced stage of HIV infection is Acquired Immunodeficiency Syndrome (AIDS), which can take from 2 to 15 years to develop depending on the individual. AIDS is defined by the development of certain cancers, infections, or other severe clinical manifestations.

Transmission: HIV can be transmitted via the exchange of a variety of body fluids from infected individuals, such as blood, breast milk, semen and vaginal secretions. Individuals cannot become infected through ordinary day-to-day contact such as kissing, hugging, shaking hands, or sharing personal objects, food or water.

Symptoms of HIV: vary depending on the stage of infection. Though people living with HIV tend to be most infectious in the first few months, many are unaware of their status until later stages. The first few weeks after initial infection, individuals may experience no symptoms or an influenza-like illness including fever, headache, rash, or sore throat. As the infection progressively weakens the immune system, an individual can develop other signs and symptoms, such as swollen lymph nodes, weight loss, fever, diarrhoea and cough. Without treatment, they could also develop severe illnesses such as tuberculosis, cryptococcal meningitis, severe bacterial infections and cancers such as lymphomas and Kaposi's sarcoma, among others.

(c) Human Papilloma virus (HPV): Human papillomavirus (HPV) is the most common viral infection of the reproductive tract. The peak time for acquiring infection for both women and men is shortly after becoming sexually active. HPV is sexually transmitted, but penetrative sex is not required for transmission. Skin-to-skin genital contact is a well-recognized mode of transmission. Cervical cancer is by far the most common HPV-related disease. Nearly all cases of cervical cancer can be attributable to HPV infection.

The majority of HPV infections do not cause symptoms or disease and resolve spontaneously. However, persistent infection with specific types of HPV (most frequently types 16 and 18) may lead to precancerous lesions. If untreated, these lesions may progress to cervical cancer, but this progression usually takes many years. Symptoms of cervical cancer tend to appear only after the cancer has reached an advanced stage and may include: irregular, intermenstrual (between periods) or abnormal vaginal bleeding after sexual intercourse; back, leg or pelvic pain; fatigue, weight loss, loss of appetite; vaginal discomfort or odourous discharge; and a single swollen leg.

(d) Hepatitis B: Hepatitis B is a serious infection of the liver caused by a virus.

Transmission: There are several ways of getting hepatitis B. One way is by sexual contact with an infected person. Hepatitis B virus is transmitted through blood and body fluids especially through anal sex. Other ways are by sharing personal items (toothbrushes, razors, etc.), and sharing needles or equipment for injection drug use. Healthcare and emergency service workers can get it through needle stick injuries or blood splashes in the eyes, nose, mouth or on broken skin.

Symptoms: Tiredness, loss of appetite, stomach discomfort and yellow skin. The virus is found in blood, semen, vaginal fluids and saliva. Hepatitis B is the only sexually transmitted disease that has a safe and effective vaccine to prevent infection.

Prevention:

- The surest way to avoid transmission of STDs is to abstain from sexual contact, or to be in a long-term mutually monogamous relationship with a partner who has been tested and is known to be uninfected.
- Proper use of condoms can reduce the risk of transmission of STDs.
- An appropriate sexual risk assessment by a health care provider should always be conducted and may indicate more frequent screening for some women.
- Any genital symptoms such as an unusual sore, discharge with odour, burning during urination, or bleeding between menstrual cycles could mean an STD infection. If a woman has any of these symptoms, she should stop having sex and consult a health care provider immediately.

Study of Recent Outbreaks of Human Diseases

(a) SARS:

Background: SARS first sprang to the world's attention in early 2003, when more than 8,000 people got sick in an outbreak that spread to 26 countries. Nearly 800 people died.

Doctors and scientists tracked the disease to southeastern China, near Hong Kong. From there, travelers soon carried SARS to other countries in Asia, such as Vietnam and Singapore, as well as Europe and Canada. Public health officials around the world scrambled to contain no reported cases since 2004.

The SARS coronavirus (SARS-CoV) causes SARS. A coronavirus is a common form of virus that typically causes upper-respiratory tract illnesses. The common cold results from a kind of coronavirus.

Six different kinds of coronavirus are known to infect humans. Four of these are common, and most people will experience at least one of them at some time in their life.

The two other types cause SARS and Middle East Respiratory Syndrome (MERS). These are less common but far more deadly. Before SARS appeared, coronaviruses had not been particularly dangerous to humans, but they had been known to cause severe diseases in animals.

Symptoms are similar to those of the flu, including: fever over 100.4°F; dry cough; sore throat; problems breathing, including shortness of breath; headache; body aches; loss of appetite; malaise; night sweats and chills; confusion; rash; diarrhea. Breathing issues will appear within 2 to 10 days after a person is exposed to the virus.

Causes: Droplets from coughing and sneezing and close human contact likely transmit the SARS virus. The respiratory droplets are probably absorbed into the body through the mucous membranes of the mouth, nose, and eyes. This could be through: hugging and kissing, sharing utensils for eating and drinking, speaking to someone within a distance of 3 feet, touching someone directly, A person with the virus can spread the infection by leaving respiratory droplets on objects, such as door handles, doorbells, and telephones. These are then picked up by someone else, The virus is likely to remain active in the environment for several days.

Prevention: Good personal hygiene practices can help restrict the spread of the virus. These include: frequent hand washing, avoiding touching the eyes, mouth or nose with unclean hands, covering the mouth and nose with a tissue when coughing or sneezing, encouraging others to do the same. There is currently no vaccine against SARS, but scientists are working on one.

(b) Swine flu: The disease is spread among pigs by direct and indirect contact, aerosols, and from pigs that are infected but do not have symptoms. In many parts of the world, pigs are vaccinated against swine flu. Most commonly, swine flu is of the H1N1 influenza subtype. However, swine flu viruses can sometimes come from other subtypes, such as H1N2, H3N1, and H3N2.

The 2009 outbreak of swine flu that infected humans was of the H1N1 subtype. It is important to note that, although it developed in swine, the 2009 pandemic virus was not completely derived from swine. The virus contains a combination of flu genes from bird, swine, and human flu types.

Causes: There are only a few causes of swine flu in humans. They are:

Contact with infected pigs: This is the most common way of catching swine flu. Any contact with infected pigs makes transmission more likely.

Contact with infected humans: This is a much less common way of catching swine flu, but is a risk, especially for those in close contact with an infected person. In cases where humans have infected other humans, close contact was necessary with the infected person, and it nearly always occurred in closed groups of people.

Symptoms: The symptoms of swine flu in humans are quite similar to those of regular flu, and include: body aches, chills, cough, headache, sore throat, fever, tiredness; Less commonly, a person with swine flu may experience vomiting and diarrhea.

Diagnosis: Swine flu is mostly diagnosed through noting the symptoms. There is also a quick test called the rapid influenza diagnostic test that can help identify swine flu. However, these vary in effectiveness and may show a negative result even though influenza is present. More accurate tests are available in more specialized laboratories.

Prevention and control: Personal hygiene plays a major role in the prevention of the disease. A vaccine has been produced to protect humans against the H1N1 strain of swine flu. This was introduced following a pandemic of swine flu in 2009 and 2010.

(c) Ebola

Background: Ebola virus disease (EVD) first appeared in 1976 in 2 simultaneous outbreaks, one in what is now, Nzara, South Sudan, and the other in Yambuku, Democratic Republic of Congo. The latter occurred in a village near the Ebola River, from which the disease takes its name.

The 2014–2016 outbreak in West Africa was the largest and most complex Ebola outbreak since the virus was first discovered in 1976. There were more cases and deaths in this outbreak than all others combined. It also spread between countries, starting in Guinea then moving across land borders to Sierra Leone and Liberia.

The virus family *Filoviridae* includes three genera: *Cuevavirus, Marburgvirus*, and *Ebola* virus. Within the genus *Ebola* virus, five species have been identified: *Zaire, Bundibugyo, Sudan, Reston* and *Taï Forest*. The first three, *Bundibugyo ebola* virus, *Zaire ebola* virus, and *Sudan ebola* virus have been associated with large outbreaks in Africa. The virus causing the 2014–2016 West African outbreak belongs to the *Zaire ebola* virus species.

Transmission: It is thought that fruit bats of the *Pteropodidae* family are natural *Ebola* virus hosts. Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines.

Ebola then spreads through human-to-human transmission via direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and with surfaces and materials (e.g. bedding, clothing) contaminated with these fluids and also by sexual contact.

Symptoms of Ebola virus disease: The incubation period of virus is 2 to 21 days. Humans are not infectious until they develop symptoms. First symptoms are the sudden onset of fever fatigue, muscle pain, headache and sore throat. This is followed by vomiting, diarrhoea, rash, symptoms of impaired kidney and liver function, and in some cases, both internal and external bleeding (e.g. oozing from the gums, blood in the stools).

Diagnosis: Confirmation that symptoms are caused by Ebola virus infection are made using the following diagnostic methods:

- antibody-capture enzyme-linked immunosorbent assay (ELISA)
- antigen-capture detection tests
- serum neutralization test
- reverse transcriptase polymerase chain reaction (RT-PCR) assay
- electron microscopy
- virus isolation by cell culture.

Prevention and control: Raising awareness of risk factors for Ebola infection and protective measures (including vaccination) that individuals can take is an effective way to reduce human transmission. Risk reduction messaging should focus on several factors:

- Reducing the risk of wildlife-to-human transmission from contact with infected fruit bats or monkeys/apes and the consumption of their raw meat. Animals should be handled with gloves and other appropriate protective clothing. Animal products (blood and meat) should be thoroughly cooked before consumption.
- Reducing the risk of human-to-human transmission from direct or close contact with people with Ebola symptoms, particularly with their bodily fluids. Gloves and appropriate personal protective equipment should be worn when taking care of ill patients at home. Regular hand washing is required after visiting patients in hospital, as well as after taking care of patients at home.
- Reducing the risk of possible sexual transmission

An experimental Ebola vaccine proved highly protective against the deadly virus in a major trial in Guinea. The vaccine, called rVSV-ZEBOV, was studied in a trial involving 11 841 people during 2015. Among the 5837 people who received the vaccine, no Ebola cases were recorded 10 days or more after vaccination.

Mosquito-borne diseases: Mosquito-borne illnesses are diseases caused by bacteria, viruses or parasites transmitted by mosquitoes. They can transmit disease without being affected themselves. Diseases transmitted by mosquitoes include: Malaria, Dengue, West Nile virus, Chikungunya, Yellow fever, Filariasis, Tularemia, dirofilariasis, Japanese encephalitis, Saint Louis encephalitis, Western equine encephalitis, Eastern equine encephalitis, Venezuelan equine encephalitis, Ross River fever, Barmah Forest fever, La Crosse encephalitis, and Zika fever.

Types: 1. Protozoa MBD:

(a) Malaria: is an acute or subacute infectious disease caused by one of four protozoan species of the genus *Plasmodium: P. falciparum, P. vivax, P. ovale,* or *P. malariae,* mainly transmitted by *Anopheles* mosquitoes. Occasionally, transmission occurs by blood transfusion, organ transplantation, needle-sharing, or congenitally from mother to foetus.

Symptoms: In a non-immune individual, symptoms appear 7 days or more (10-15 days) after the bite of an infected mosquito. The first symptoms are fever, headache, chills and vomiting. Severe *falciparum* malaria is almost always fatal without treatment.

Diagnosis: The gold standard for laboratory confirmation of malaria remains the identification of malaria parasites in blood films. Alternate methods for laboratory diagnosis include 1) antigen detection using rapid diagnostic tests, a useful alternative in situations where reliable microscopic diagnosis is not available; 2) molecular diagnosis, which is more accurate than microscopy and (currently still) requiring a specialised laboratory; and 3) serology, using indirect immuno-fluorescence (IFA) or enzyme-linked immuno-sorbent assay (ELISA).

Prevention: Prevention of malaria is currently based on two complementary methods: chemoprophylaxis and protection against mosquito bites.

Mosquito control: Because of the nocturnal feeding habits of most of *Anopheles* mosquitoes, malaria transmission occurs primarily at night. The main current measures are focused on reduction of the contact between mosquitoes and humans, the destruction of larvae by environmental management and the use of larvicides or mosquito larvae predators, and destruction of adult mosquitoes by indoor residual spraying and insecticide-treated bed nets.

2. Helianthus MBD:

(a) Lymphatic filariasis: commonly known as elephantiasis, is a neglected tropical disease. Infection occurs when filarial parasites are transmitted to humans through mosquitoes. Infection is usually acquired in childhood causing hidden damage to the lymphatic system. Elephantiasis causing enlargement of genitals can be caused by bacteria called *lymphogranuloma venereum* which can be transmitted through sexual intercourse.

Symptoms: Lymphatic filariasis infection involves asymptomatic, acute, and chronic conditions. The majority of infections are asymptomatic, showing no external signs of infection while contributing to transmission of the parasite. Inflammation involving skin, lymph nodes and lymphatic vessels, darkened skin and enlargement of genitals.

Diagnosis: Microfilariae sometimes can be seen in blood under a microscope. Often the doctor diagnoses the disorder based on the symptoms and a medical history, after ruling out other disorders with similar symptoms.

Prevention: Depending on the parasite-vector species, measures such as insecticide-treated nets, indoor residual spraying or personal protection measures may help protect people from infection. The use of insecticide-treated nets in areas where *Anopheles* is the primary vector for filariasis enhances the impact on transmission.

3. Virus MBDs:

(a) **Chikungunya fever:** Chikungunya is a viral disease transmitted by *Aedes* mosquitoes to humans. The word ‘chikungunya’ means 'that which bends up', an allusion to the posture of the suffering patients. The virus was first identified in Tanzania in 1953. The virus is a single-stranded RNA enveloped virus from the *Togaviridae* family, genus *Alphavirus*. Chikungunya is spread by the bite of Aedes mosquitoes, primarily *Aedes aegypti* and

also *Aedes albopictus*, two species which can also transmit other mosquito-borne viruses, including dengue virus. These mosquitoes are active during the day. Both species are found biting outdoors, but *Aedes aegypti* will also readily feed indoors.

Symptoms: Fever, severe joint, muscle pain, headache, nausea, fatigue and rash. The onset of chikungunya, after a mosquito bite, usually occurs between 4 and 8 days, but can also range from 2 to 12 days

Diagnostics: Chikungunya virus can be identified using nucleic acid/genomic amplification techniques or viral isolation during the first week of illness. Serological diagnosis can be performed by detection of specific IgM antibodies in serum specimen from day 4–5 after the onset of illness. Specific IgM can persist for many months, in particular in patients with long-lasting arthralgia

Prevention: Prevention is also based on protection against mosquito bites. *Aedes* mosquitoes have diurnal biting activities in both indoor and outdoor environments. Therefore personal protection measures should be applied all day long and especially during the hours of highest mosquito activity (mid-morning, late afternoon to twilight).

(b) Zika virus disease: Zika virus disease is caused by a virus from the *Flavivirus* genus, Flaviviridae family, from the Spondweni group. It was first isolated in 1947 from a monkey in the Zika forest, Uganda, then in mosquitoes (*Aedes africanus*) in the same forest in 1948, and in a human in Nigeria in 1952.

Transmission: Mosquitoes infect humans and people can infect each other through sexual transmission. Zika has been detected in blood, saliva, semen, spinal and other body fluids. Mother to child transmission in early pregnancy has also been reported.

Symptoms: Symptoms are usually mild and can include mild fever, skin rash, inflammation of the eyes (conjunctivitis), muscle and joint pain, malaise or headache. Symptoms normally last for 2 - 7 days. Zika infection during pregnancy causes microcephaly, babies born with small heads, and other fetal brain malformations. Zika is also a cause of Guillain-Barré Syndrome - a neurological condition that can lead to paralysis and death.

Diagnostics: Zika virus disease diagnostics is primarily based on the detection of viral RNA from clinical specimens (blood, saliva, urine, cerebrospinal fluid, amniotic fluid, semen, and breast milk). Serological investigations can be conducted from day 5 after the onset of disease, by detection of Zika-specific IgM antibodies and confirmation by neutralisation, seroconversion or fourfold antibody titre increase of Zika-specific antibodies in paired serum samples.

Prevention: Primary prevention is based on protection against mosquito bites. *Aedes* mosquitoes have diurnal biting activities in both indoor and outdoor environments. Therefore personal protection measures should be applied all day, especially during the hours of the highest mosquito activity (mid-morning, late afternoon to twilight). Sexual transmission of Zika virus through semen has been documented, therefore practicing safer sex (including the use of condoms) is recommended throughout pregnancy to protect the foetus.

(c) Dengue fever: Dengue is caused by a virus of the Flaviviridae family, *Flavivirus* genus which includes viruses such as yellow fever, West Nile and tick-borne encephalitis. Dengue is a mosquito-borne viral disease widely spread in tropical and subtropical regions. The disease is transmitted by *Aedes* mosquitoes, which breed in the peridomestic environment.

Symptoms: Flu-like symptoms occur 4-10 days after the bite of an infected mosquito; high fever accompanied by severe headache, pain behind the eyes, muscle and joint pains, nausea, vomitting, swollen glands or rash may occur. Symptoms of severe dengue include decrease in temperature, severe abdominal pain, persistent vomiting, rapid breathing, bleeding gums, fatigue, restlessness and blood in vomit.

Diagnostics: Dengue viral genome can be detected by RT-PCR in blood specimens up to day five of illness. Another approach is the detection of the non-structural-1 (NS1) dengue antigen up to day four post-onset. However sensitivity of the assay is depending on the serotype.

Prevention: Prevention is also based on protection against mosquito bites. *Aedes* mosquitoes have diurnal biting activities in both indoor and outdoor environments. Therefore personal protection measures should be applied all day long and especially during the hours of highest mosquito activity (mid-morning, late afternoon to twilight).

(d) Yellow fever (YF): is an African mosquito-borne infection of primates. It is caused by a virus of the *Flavivirus* genus of the *Flaviviridae* family. Bites by infected mosquitoes are the only mode of transmission. New infections in humans can occur when saliva that contains the virus is injected into a non-immune host during subsequent blood meals. The extrinsic incubation period of virus is about ten days, depending on the temperature.

Symptoms: After 3-6 days, symptoms include fever, muscle pains, backache, headache, shivers, loss of appetite, nausea or vomiting. Roughly 15 % of patients enter a second, more toxic phase within 24 hours. Symptoms of this phase may include high fever, jaundice, and abdominal pain with vomiting. Bleeding can occur from the mouth, nose, eyes or stomach and blood appears in the vomit and faeces, and kidney function may deteriorate. Half of the patients who enter the toxic phase die within 10-14 days, the rest recover without significant organ damage.

Diagnosis: The virus can be detected in blood specimens by RT-PCR, antigen-capture and/or viral isolation. A serological diagnosis can be made by detection of specific IgM antibodies one week after infection. Exposure to YF virus confers lifelong immunity.

Prevention: A safe, effective and inexpensive yellow fever attenuated vaccine, known as YF 17D, has been used for more than half a century. The vaccine is highly effective but routine vaccination is implemented by very few countries.

Unit- II; Possible Questions

Part-A (1 Mark)

Part-B (2 Mark)

1. Mention any two upper respiratory and lower respiratory microbial diseases
2. Name any two bacterial and parasitic infections of eye.
3. What is Staphylococcal scalded skin syndrome?
4. Define Mosquito borne diseases
5. What is Meningitis?
6. What is conjunctivitis and keratitis?
7. Mention any four sexually transmitted diseases
8. What is SARS?
9. Mention any two viral mosquito borne diseases
10. Define Pyelonephritis and Glomerulonephritis

Part-C (8 Mark)

1. Write a detail note on respiratory microbial diseases.
2. Write in detail about the skin diseases
3. Write a detail note on gastrointestinal diseases
4. Write a detail note on eye diseases
5. Write a note on sexually transmitted disease
6. Write in detail about the urinary tract diseases.
7. Discuss the history, causes, spread and control of Ebola.
8. Write a note on Swine Flu
9. Discuss the causes, spread and control of SARS
10. Give a detailed note on mosquito borne diseases.

KARPAGAM ACADEMY OF HIGHER EDUCATION

CLASS: III B.Sc MB COURSE NAME: Management of Human Microbial Diseases

COURSE CODE: 17MBU501A UNIT: II BATCH-2017-2020

Sl.No	Questions	Opt A	Opt B	Opt C	Opt D	Answer
1	Which of the following is the vaccine used for prevention of pneumococcal disease?	Pneumovax	Prevnar (PCV13)	All the above	None of the above	All the above
2	An incubation for common cold is _____h.	48 to 72	24 to 72	24 to 48	48 to 96	48 to 72
3	_____ is the causative agent of peptic ulcers in humans	*L. monocytogenes*	*H. pylori*	*Rota* virus	*Y. enterocolitica*	*H. pylori*
4	_____ is the incubation period of Ebola virus	2 to 30 days	2 to 21 days	4 to 21 days	4 to 30 days	2 to 21 days
5	*Coronavirus* is a common form of virus that typically causes _____ tract illnesses	Upper-respiratory tract	Lower-urinary tract	Lower-respiratory tract	Upper-urinary tract	Upper-respiratory tract
6	Human African Trypanosomiasis is a microbial diseases associated with _____.	Eyes	Nervous system	Kidneys	Lungs	Nervous system
7	Which of the following are NOT lower respiratory infections	Bronchitis	Pneumonia	Laryngotracheitis	Bronchiolitis	Laryngotracheitis
8	_____ is the causative agent of Dental caries.	*S. sonnei*	*S. mutans*	*S. dysenteriae*	*S. flexneri*	*S. mutans*
9	_____ is the causative agent of Eosinophilic cystitis	*E.coli*	*S. saprophyticus*	*S. pyogenes*	*S. haematobium*	*S. haematobium*
10	_____ is the incubation period of Rabies	2 to 3 days	2 to 7 days	1 to 3 days	4 to 8 days	1 to 3 days
11	_____ is the causative agent of cystitis in humans	*Listeria monocytogenes*	*Helicobacter pylori*	*Escherichia coli*	*Y. enterocolitica*	*Escherichia coli*
12	*Leptospira* typically causes _____ illnesses.	Respiratory tract	Urinary tract	Gastrointestinal tract	None of the above	Urinary tract
13	Keratitis and Cytomegalovirus Retinitis	Eyes	Nervous system	Kidneys	Lungs	Eyes

	are the microbial diseases associated with _____.					
14	Improperly canned foods can create an environment ripe for *Clostridium botulinum*, which can lead to _____.	Botulism	Tetanus	Both A and B	None of the above	Both A and B
15	_____ are infectious diseases naturally transmitted from animals to humans	Brucellosis	Toxocariasis	Sparganosis	Zoonoses	Zoonoses
16	The causative agent of Candidiasis and Trichomoniasis a _____ respectively	*Trichomonas* sp. and *Candida sp*	*Trichomonas* sp. and *Chlamydia* sp	*Candida sp.* and *Trichomonas* sp.	*Candida sp.*and *Chlamydia* sp.	*Candida sp.* and *Trichomonas* sp.
17	_____ is the incubation period of SARS	2 to 30 days	1 to 10 days	1 to 21 days	4 to 30 days	1 to 10 days
18	Bacterial conjunctivitis is most commonly caused by _____.	*Haemophilus influenzae*	*S. pneumoniae*	*Moraxella catarrhalis*	All the above	All the above
19	Syphilis is a sexually transmitted infection caused by the bacterium _____.	*Treponema pallidum*	*Treponema carateum*	*Treponema azotonutricium*	*Treponema pectinovorum*	*Treponema pallidum*
20	Female Aedes aegypti mosquito spread _____.	Chikungunya	Rubella	Dengue	Both A and C	Both A and C
21	Chancroid is a sexually transmitted infection caused by the bacterium _____.	*Treponema pallidum*	*Haemophilus ducreyi*	*Neisseria gonorrhoeae*	*Chlamydia trachomatis*	*Haemophilus ducreyi*
22	The causative agent of Yellow fever is _____.	*Flavivirus*	Zika virus	*Alphavirus*	None of the above	*Flavivirus*
23	Pyelonephritis and Glomerulonephritis are the microbial diseases associated with _____.	Eyes	Nervous system	Kidneys	Lungs	Kidneys
24	Which of the following are NOT subtypes of swine flu viruses?	H1N1 influenza	H1N2 influenza	H3N8 influenza	H3N1 influenza	H3N8 influenza
25	Elephantiasis causing enlargement of	*lymphogranuloma*	*Mansonella*	*Onchocerca*	*Wuchereria*	*lymphogranuloma*

	genitals can be caused by bacteria called _____.	*venereum*	*ozzardi*	*volvulus*	*bancrofti*	*venereum*
26	_____ is the incubation period of *C. tetani.*	7 to 10 days	2 to 21 days	7 to 21 days	4 to 30 days	7 to 21 days
27	*Anopheles* mosquitoes spread _____.	Chikungunya	Dengue	Both A and B	Malaria	Both A and B
28	_____ is reffered as genital herpes	HSV-1	HSV-2	Both A and B	None of the above	HSV-2
29	Amoebic Meningitis is most commonly caused by _____.	*Balamuthia mandrillaris*	*Naegleria fowleri*	*Cryptococcus neoformans*	*N. meningitidis*	*Naegleria fowleri*
30	Shingles and Impetigo are the microbial diseases associated with _____.	Eyes	Nervous system	Kidneys	Skin	Skin
31	BCG injections are given to children to vaccinate them against _____.	Influenza	Pneumonia	Chicken pox	Tuberculosis	Tuberculosis
32	Transfusion of infected blood is main reason for spread of diseases like _____.	AIDS	Polio	Hepatitis B	Both A and C	Both A and C
33	Ebola virus infections can be diagnosed in a laboratory through _____.	Polymerase chain reaction	IgM ELISA	Virus isolation	All the above	All the above
34	Bacterial conjunctivitis is most commonly caused by _____.	*Haemophilus influenzae*	*S. pneumoniae*	*Moraxella catarrhalis*	All the above	All the above
35	Which of the following is the most common cause of neonatal meningitis?	*Haemophilus influenzae* b	*Neisseria meningitidis*	*Streptococcus agalactiae*	*Streptococcus pneumoniae*	*Streptococcus agalactiae*
36	_____ is also a cause of Guillain-Barré Syndrome - a neurological condition that can lead to paralysis and death.	Zika virus	*Flavivirus*	*Alphavirus*	All the above	Zika virus
37	Hepatitis B is a serious infection of the ____ caused by a virus	Kidney	liver	Nervous system	Skin	liver
38	In of the cases, cervical cancer can be	HPV	HIV	Hepatitis B	HSV	HPV

	attributable to ____ infection.					
39	The causative agent of Dengue fever is_____.	*Flavivirus*	Zika virus	*Alphavirus*	None of the above	*Flavivirus*
40	Granulomatous Encephalitis is causd by *Acanthamoeba* affecting _____.	cornea	retina	brain and spinal cord	entire body	brain and spinal cord
41	Conjunctivitis due to _____ typically occurs one week after birth	*Staphylococcus aureus*	*Streptococcus pneumoniae*	N. gonorrhea	chlamydia	chlamydia
42	Chickenpox is caused by _____.	*Trypanosoma brucei*	*Streptococcus pyogenes*	*Varicella zoster virus*	*Streptococcus agalactiae*	*Varicella zoster virus*
43	Meningococcal Meningitisis caused by _____.	*N. meningitidis*	*Haemophilus influenza*	*Listeria monocytogenes*	*Escherichia coli*	*N. meningitidis*
44	hydrocephalus is also called as_____	water on the lungs	water on the brain	mucous on the lungs	Mucous on the brain	water on the brain
45	which of the following mosquitoe borne diseases is sexually transmitted?	Chikungunya fever	Zika virus disease	Dengue fever	Yellow fever	Zika virus disease
46	_____ is a vaccine used against Yellow fever	YF 12D	YF 10D	YF 15D	YF 17D	YF 17D
47	*Varicella* has an incubation period of _____ days.	10 to 21	12 to 15	5 to 10	15 to 21	10 to 21
48	Cryptococcocal Meningitis is caused by _____.	*N. meningitidis*	*Haemophilus influenza*	*Cryptococcus neoformans*	*Listeria monocytogenes*	*Cryptococcus neoformans*
49	Impetigo is caused by _____.	Streptococcus pyogenes	*Mycobacterium leprae*	*Trichophyton mentagrophytes*	*Microsporum canis*	Streptococcus pyogenes
50	Community-acquired pneumonias caused by _____.	*Yersinia pestis*	*Staphylococcus aureus*	*Francisella tularensis*	*Pseudomonas aeruginosa*	*Staphylococcus aureus*
51	which of the following diseases can be prevented by taking vaccine?	Laryngotracheitis	Common Cold	Sinusitis	Pharyngitis	Laryngotracheitis
52	_____ is reffered as oral herpes	HSV-1	HSV-2	Both A and B	None of the	HSV-1

					above	
53	Cystitis is a common form of virus that typically causes _____ tract illnesses	Upper-respiratory tract	Lower-urinary tract	Lower-respiratory tract	Upper-urinary tract	Lower-urinary tract
54	_____ infection during pregnancy causes microcephaly	Zika virus	Marburgvirus	Ebola virus	Non of th abov	Zika virus
55	The virus family *Filoviridae* includes three genera: _____, *Marburgvirus* and *Ebola* virus	Cuevavirus	*Zaire virus*	Bundibugyo virus	Sudan virus	Cuevavirus
56	Myalgia reffers to _____.	abnormal voice changes	swallowing	a deep barking cough	pain in a muscle	pain in a muscle
57	_____ of the Pteropodidae family are natural *Ebola* virus hosts	Pigs	Fruit bats	Dogs	Cats	Fruit bats
58	_____causes SARS	SARS coronavirus	Bundibugyo virus	Sudan virus	Cuevavirus	SARS coronavirus
59	_____, bacterium has only recently been identified as a sexually transmitted infection (STI).	Lymphogranuloma Venereum	Mycoplasma Genitalium	*Haemophilus ducreyi*	None of the above	Mycoplasma Genitalium
60	Coronavirus causes SARS and _____.	Middle North Respiratory Syndrome	Middle East Respiratory Syndrome	Middle West Respiratory Syndrome	None of the above	Middle East Respiratory Syndrome

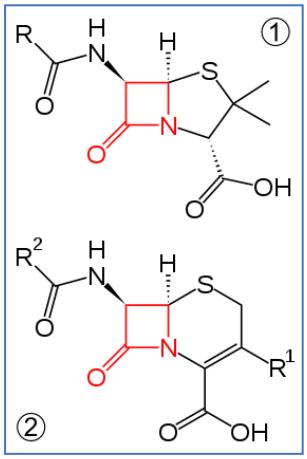
Unit III

Syllabus

Treatment using antibiotics: beta lactam antibiotics (penicillin, cephalosporins), quinolones, polypeptides and aminoglycosides. Anti-fungal and anti-parasitic agents.Judicious use of antibiotics, importance of completing antibiotic regimen, Concept of DOTS, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains. Treatment using antiviral agents: Amantadine, Acyclovir, Azidothymidine. Concept of HAART.

Treatment using antibiotics

1. Beta lactum antibiotics: β-lactam antibiotics (beta-lactam antibiotics) are a class of broad-spectrum antibiotics, consisting of all antibiotic agents that contain a beta-lactam ring in their molecular structures. This includes penicillin derivatives (penams), cephalosporins (cephems), monobactams and carbapenems.



Core structure of penicillins (top) and cephalosporins (bottom)

β-lactam antibiotics are bacteriocidal, and act by inhibiting the synthesis of the peptidoglycan layer of bacterial cell walls. The peptidoglycan layer is important for cell wall structural integrity, especially in Gram-positive organisms, being the outermost and primary component of the wall. The final transpeptidation step in the synthesis of the peptidoglycan is facilitated by DD-transpeptidases which are penicillin binding proteins (PBPs). PBPs vary in their affinity for binding penicillin or other β-lactam antibiotics. The amount of PBPs varies among bacterial species.

β-lactam antibiotics are analogues of D-alanyl-D-alanine the terminal amino acid residues on the precursor NAM/NAG-peptide subunits of the nascent peptidoglycan layer. The structural similarity between β-lactam antibiotics and D-alanyl-D-alanine facilitates their binding to the active site of PBPs. The β-lactam nucleus of the molecule irreversibly binds to (acylates) the Ser_{403} residue of the PBP active site. This irreversible inhibition of the PBPs prevents the final cross linking (transpeptidation) of the nascent peptidoglycan layer, disrupting cell wall synthesis.

(a) Penicillin: Penicillin antibiotics were among the first medications to be effective against many bacterial infections caused by *Staphylococci* and *Streptococci*. Penicillin was discovered in 1928 by Scottish scientist Alexander Fleming.

While the number of penicillin-resistant bacteria is increasing, penicillin can still be used to treat a wide range of infections caused by certain susceptible bacteria, including *Streptococci*, *Staphylococci*, *Clostridium*, *Neisseria*, and *Listeria* genera.

Penicillins can be classified into the following groups;

1. Natural Penicillins: Penicillin G**,** Penicillin K**,** Penicillin N**,** Penicillin O and Penicillin V
2. Beta lacatamse resistant Penicillins: Methicillin, Nafcillin, Oxacillin, Cloxacillin and Dicloxacillin
3. Aminopenicillins: Ampicillin and Amoxicillin
4. Carboxypenicillins: Carcenicillin and Ticarcillin
5. Ureidopenicillins: Mezlocillin and Piperacillin
   Penicillins/inhibitor combination: Ampicillin/sulbactam, Ticarcillin/clavulanate, Piperacillin/tazobactam and Amoxicillin/clavulanate

Common (≥ 1 % of people) adverse drug reactions associated with use of the penicillins include diarrhoea, hypersensitivity, nausea, rash, neurotoxicity, urticaria, and super infection (including candidiasis). Infrequent adverse effects (0.1–1 % of people) include fever, vomiting, erythema, dermatitis, angioedema, seizures (especially in people with epilepsy), and pseudomembranous colitis.

(b) Cephalosporin: are a class of β-lactam antibiotics originally derived from the fungus *Acremonium*, which was previously known as *Cephalosporium.* Cephalosporins are indicated for the prophylaxis and treatment of infections caused by bacteria susceptible to this particular form of antibiotic. First-generation cephalosporins are active predominantly against Gram-positive bacteria, and successive generations have increased activity against Gram-negative bacteria.

First generation:
Gram-positive: penicillinase-producing, methicillin- susceptible *Staphylococci* and *Streptococci* (though they are not the drugs of choice for such infections). No activity against methicillin-resistant *Staphylococci* or *Enterococci*.
Gram-negative: *Proteus mirabilis*, some *Escherichia coli*, and *Klebsiella pneumoniae*, but have no activity against *Bacteroides fragilis*, *Pseudomonas*, *Acinetobacter*, *Enterobacter*, indole-positive *Proteus*, or *Serratia*.

Second generation: Cefaclor, Cefonicid, Cefprozil, Cefuroxime, Cefuzonam, Cefmetazole, Cefotetan, Cefoxitin, Loracarbef, Cefbuperazone, Cefmetazole, Cefminox, Cefotetan, Cefoxitin, Cefotiam
Gram-positive: Less than first-generation.
Gram-negative: Greater than first-generation: *Haemophilus influenzae*, *Klebsiella pneumonia*, *Enterobacter aerogenes* and some *Neisseria* sp.

Third generation: Cefcapene, Cefdaloxime, Cefdinir, Cefditoren, Cefetamet, Cefixime, Cefmenoxime, Cefodizime, Cefotaxime, Cefovecin, Cefpimizole, Cefpodoxime, Cefteram, Ceftamere, Ceftibuten, Ceftiofur, Ceftiolene, Ceftizoxime, Ceftriaxone, Cefoperazone, Ceftazidime
Gram-positive: Less than first-generation.
Gram-negative: They may be particularly useful in treating hospital-acquired infections. They are also able to penetrate the central nervous system, making them useful against meningitis caused by pneumococci, meningococci, *H. influenzae*, and susceptible *E. coli*, *Klebsiella*, and penicillin-resistant *N. gonorrhoeae*.

Fourth generation: Cefclidine, Cefepime, Cefluprenam, Cefoselis, Cefozopran, Cefpirome, Cefquinome
Gram-positive: They are extended-spectrum agents with similar activity against Gram-positive organisms as first-generation cephalosporins.
Gram-negative: Fourth-generation cephalosporins are zwitterions that can penetrate the outer membrane of Gram-negative bacteria. They also have a greater resistance to β-lactamases than the third-generation cephalosporins. Many can cross the blood–brain barrier and are effective in meningitis. They are also used against *Pseudomonas aeruginosa,* pneumococci, meningococci, *N. gonorrhoeae, H. influenzae*

Fifth generation: Ceftobiprole, Ceftaroline, Ceftolozane

Ceftobiprole has powerful antipseudomonal characteristics and *appears* to be less susceptible to development of resistance. Ceftolozane is a new option for treatment of Complicated Intra-abdominal Infections (cIAI), and Complicated Urinary Tract Infections (cUTI). Ceftolozane is combined with the β-lactamase inhibitor tazobactam, as multi-drug resistant bacterial infections will generally show resistance to all β-lactam antibiotics unless this enzyme is inhibited.

Resistance to cephalosporin antibiotics can involve either reduced affinity of existing PBP components or the acquisition of a supplementary β-lactam-insensitive PBP. Currently, some *Citrobacter freundii, Enterobacter cloacae, Neisseria gonorrhoeae,* and *Escherichia coli* strains are resistant to cephalosporins. Some *Morganella morganii, Proteus vulgaris, Providencia rettgeri, Pseudomonas aeruginosa,* and *Serratia marcescens* strains have also developed resistance to cephalosporins at varying degrees.

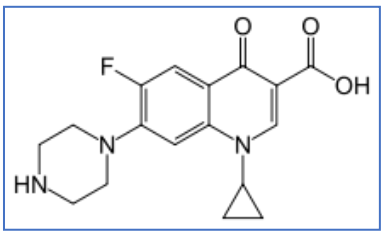
The mnemonic "LAME" is used to note organisms against which cephalosporins do not have activity

- *Listeria*
- Atypicals (including *Mycoplasma* and *Chlamydia*)
- MRSA
- *Enterococci*

Common adverse drug reactions (ADRs) (≥ 1 % of patients) associated with the cephalosporin therapy include: diarrhea, nausea, rash, electrolyte disturbances, and pain and inflammation at injection site. Infrequent ADRs (0.1–1 % of patients) include vomiting, headache, dizziness, oral and vaginal candidiasis, pseudomembranous colitis, superinfection, eosinophilia, nephrotoxicity, neutropenia, thrombocytopenia, and fever.

2. Quinolones: A quinolone antibiotic is any member of a large group of broad-spectrum bactericides that share a bicyclic core structure related to the compound 4-quinolone. They are used in human and veterinary medicine to treat bacterial infections, as well as in animal husbandry.

Nearly all quinolone antibiotics in use are fluoroquinolones, which contain a fluorine atom in their chemical structure and are effective against both Gram-negative and Gram-positive bacteria. Example: Ciprofloxacin, levofloxacin, gatifloxacin, moxifloxacin, ofloxacin, norfloxacin



Ciprofloxacin

First generation: Nalidixic acid, Cinoxacin
Uncomplicated urinary tract infections

Second generation: Norfloxacin, Lomefloxacin, Enoxacin, Ciprofloxacin, Ofloxacin
Gram-negative organisms (including Pseudomonas species), some gram-positive organisms (including *Staphylococcus aureus*but not *Streptococcus pneumoniae*) and some atypical pathogens; (Uncomplicated and complicated urinary tract infections and pyelonephritis, sexually transmitted diseases, prostatitis, skin and soft tissue infections)

Third generation: Levofloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin
Same as for second-generation agents plus expanded gram-positive coverage (penicillin-sensitive and penicillin-resistant *S. pneumoniae*) and expanded activity against atypical pathogens; (Acute exacerbations of chronic bronchitis, community-acquired pneumonia)

Fourth generation: Trovafloxacin
Same as for third-generation agents plus broad anaerobic coverage; (urinary tract infections, intra- abdominal infections, nosocomial pneumonia, pelvic infections)

Quinolones and fluoroquinolones are chemotherapeutic bactericidal drugs, eradicating bacteria by interfering with DNA replication. Quinolones inhibit the bacterial DNA gyrase or the topoisomerase IV enzyme, thereby inhibiting DNA replication and transcription. Topoisomerase II is also a target for a variety of quinolone-based drugs.

3. Polypeptides: Polypeptide antibiotics are a chemically diverse class of anti-infective and antitumor antibiotics containing non-protein polypeptide chains. Examples of this class include actinomycin, bacitracin, colistin, and polymyxin B. Actinomycin-D has found use in cancer chemotherapy. Most other polypeptide antibiotics are too toxic for systemic administration, but can safely be administered topically to the skin as an antiseptic for shallow cuts and abrasions.

Bacitracin: acts by inhibiting cell wall synthesis. It is active mainly against gram-positive organisms (both cocci and bacilli

Tyrothricin: acts on cell membrane causing leakage and uncouples oxidative phosphorylation in the bacteria. It is active against grampositive and a few gram-negative bacteria

Polymyxin B: have high affinity for phospholipids. They have detergent-like action on the cell membrane & bind to phospholipids on the bacterial cell membrane of gram-negative bacteria causing membrane distortion or pseudopore formation i.e. disrupts cell membrane integrity. It leads to leakage of cellular components (ions, amino acids, etc.) & ultimately cell death. It is active against gram-negative bacteria only. They are active against most clinically important gram-negative bacteria except *Proteus, Serratia* and *Neisseria.*

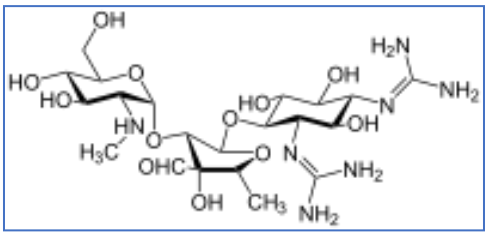
Actinomycin-D (cancer chemotherapy): is believed to produce its cytotoxic effects by binding DNA and inhibiting RNA synthesis.

4. Aminoglycosides: The first aminoglycoside, streptomycin, was isolated from *Streptomyces griseus* in 1943. Neomycin, isolated from *Streptomyces fradiae*. Gentamicin, isolated from Micromonospora in 1963.

Aminoglycosides display bactericidal, concentration-dependent killing action and are active against a wide range of aerobic gram-negative bacilli. They are also active against *Staphylococci* and certain mycobacteria. Aminoglycosides are effective even when the bacterial inoculum is large. These potent antimicrobials are used as prophylaxis and treatment in a variety of clinical situations.

Streptomycin: active against *Mycobacterium* spp, *Yersinia pestis, Enterococcus, Burkholderia, Brucella* sp
Neomycin: active against *Neisseria gonorrhoeae, Chlamydia* sp.
Gentamicin: active against *E. coli, Proteus vulgaris, Enterobacter Cloacae*

The aminoglycosides primarily act by binding to the aminoacyl site of 16S ribosomal RNA within the 30S ribosomal subunit, leading to misreading of the genetic code and inhibition of translocation. The initial steps required for peptide synthesis, such as binding of mRNA and the association of the 50S ribosomal subunit, are uninterrupted, but elongation fails to occur due to disruption of the mechanisms for ensuring translational accuracy. The ensuing antimicrobial activity is usually bactericidal against susceptible aerobic gram-negative bacilli.



Streptomycin

Streptomycin is the first-in-class aminoglycoside antibiotic. It is the earliest modern agent used against tuberculosis. Aminoglycoside can cause inner ear toxicity which can result in sensorineural hearing loss. The incidence of inner ear toxicity varies from 7 to 90 % depending of the types of antibiotics used, susceptibility of the patient to such antibiotics, and the duration of antibiotics administration.

Antifungal agents

An antifungal medication, also known as an antimycotic medication, is a pharmaceutical fungicide or fungistatic used to treat and prevent mycosis such as athlete's foot, ringworm, candidiasis (thrush), serious systemic infections such as cryptococcal meningitis, and others.

(a) Polyene antifungals: A polyene is a molecule with multiple conjugated double bonds. A polyene antifungal is a macrocyclic polyene with a heavily hydroxylated region on the ring opposite the conjugated system. This makes polyene antifungals amphiphilic. The polyene antimycotics bind with sterols in the fungal cell membrane, principally ergosterol. As a result, the cell's contents including monovalent ions (K^+, Na^+, H^+, and Cl^-), small organic molecules leak and this is regarded one of the primary ways cell dies.

Animal cells contain cholesterol instead of ergosterol and so they are much less susceptible. However, at therapeutic doses, some amphotericin B may bind to animal membrane cholesterol, increasing the risk of human toxicity. Amphotericin B is nephrotoxic when given intravenously. As a polyene's hydrophobic chain is shortened, its sterol binding activity is increased. Therefore, further reduction of the hydrophobic chain may result in it binding to cholesterol, making it toxic to animals.
Examples: Amphotericin B, Candicidin, Filipin, Hamycin, Natamycin, Nystatin, Rimocidin

(b) Imidazole, triazole, and thiazole antifungals: Azole antifungal drugs (except for abafungin) inhibit the enzyme lanosterol 14 α-demethylase; the enzyme necessary to convert lanosterol to ergosterol. Depletion of ergosterol in fungal membrane disrupts the structure and many functions of fungal membrane leading to inhibition of fungal growth.
Imidazoles:
Examples: Bifonazole, Butoconazole, Clotrimazole, Econazole, Fenticonazole, Isoconazole, Ketoconazole, Luliconazole, Miconazole, Omoconazole, Oxiconazole, Sertaconazole, Sulconazole, Tioconazole
Triazoles:
Examples: Albaconazole, Efinaconazole, Epoxiconazole, Fluconazole, Isavuconazole, Itraconazole, Posaconazole, Propiconazole, Ravuconazole, Terconazole, Voriconazole
Thiazoles:
Examples: Abafungin

(c) Allylamines: inhibit squalene epoxidase, another enzyme required for ergosterol synthesis.
Examples: Amorolfin, Butenafine, Naftifine, and Terbinafine.
(d) Echinocandins: Echinocandins may be used for systemic fungal infections in immunocompromised patients, they inhibit the synthesis of glucan in the cell wall via the enzyme 1,3-Beta-glucan synthase. Echinocandins are poorly absorbed when administered orally. When administered by injection they will reach most tissues and organs with concentrations sufficient to treat localized and systemic fungal infections.
Examples: Anidulafungin, Caspofungin and Micafungin.

Antiparasitic agents

Antiparasitics are a class of medications which are indicated for the treatment of parasitic diseases, such as those caused by helminths, amoeba, ectoparasites, parasitic fungi, and protozoa, among others. Antiparasitics target the parasitic agents of the infections by destroying them or inhibiting their growth; they are usually effective against a limited number of parasites within a particular class. They may be administered orally, intravenously or topically.

(a) Antiprotozoals:

- Melarsoprol (for treatment of sleeping sickness caused by *Trypanosoma brucei*)

- Metronidazole (for vaginitis caused by *Trichomonas*)
- Tinidazole (for intestinal infections caused by *Giardia lamblia*)
- Miltefosine (for the treatment of visceral and cutaneous leishmaniasis caused by *Leishmania* sp.)

(b) Anticestodes:
- Niclosamide (for tapeworm infections: *Diphyllobothrium latum, Hymenolepsis nana*)
- Praziquantel (for tapeworm infections: *Schistosomes, Opisthorchis viverrini, Clonorchis sinensis*)
- Albendazole (broad spectrum)

(c) Antitrematodes:
- Praziquantel (for tapeworm infections: *Schistosomes, Opisthorchis viverrini, Clonorchis sinensis*)

(d) Antiamoebics:
- Rifampin and Amphotericin B (for amoebic meningoencephalitis caused by *Naegleria fowleri*)

(e) Antinematodes:
- Mebendazole (for most nematode infections: *Ascaris humbricoides, Necator americanus*)
- Diethylcarbamazine (for treatment of Lymphatic filariasis caused by *Wuchereria bancrofti*)
- Ivermectin (for prevention of river blindness caused by *Onchocerca volvulus*)
- Pyrantel pamoate (for most nematode infections)
- Thiabendazole (for roundworm infections)

Judicious use of antibiotics

Judicious use of antibiotics is promoted largely because of the threat of antibiotic-resistant pathogens. The most common patients to receive antibiotics are infants and young children. Antibiotic resistance in the community is spread through selection of antibiotic-resistant respiratory flora submitted to antibiotic pressure during treatment of various acute diseases.

Not all antibiotics are equal in their effect on promotion of antibiotic resistant organisms. Traditionally, “judicious use of antibiotics” is translated by most clinicians as “reducing antibiotic use”. There is a need to consider all the following to successfully execute a judicious use of antibiotics:

- Treatment of bacterial infections only
- Optimize treatment by diagnosis and severity assessment
- Maximize bacterial eradication
- Recognize local resistance prevalence
- Utilize pharmacokinetics/pharmacodynamics for effective agents and dosage
- Integrate efficacy and cost effectiveness.

Concept of DOTS

Directly observed treatment, short-course (DOTS, also known as TB-DOTS) is the name given to the tuberculosis (TB) control strategy recommended by the World Health Organization. According to WHO, "The most cost-effective way to stop the spread of TB in communities with a high incidence is by curing it”. The technical strategy for DOTS was developed by Karel Styblo of the International Union Against TB & Lung Disease in the 1980s and 90s, primarily in Tanzania, but also in Malawi, Nicaragua and Mozambique.

DOTS have five main components:

- Government commitment (including political will at all levels, and establishment of a centralized and prioritized system of TB monitoring, recording and training)
- Case detection by sputum smear microscopy
- Standardized treatment regimen directly of six to nine months observed by a healthcare worker or community health worker for at least the first two months
- A drug supply
- A standardized recording and reporting system that allows assessment of treatment results

There has been a steady uptake of DOTS TB control services over the subsequent decades. Whereas less than 2 % of infectious TB patients were being detected and cured, with DOTS treatment services in 1990 approximately 60 % have been benefitted from this care. Since 1995, 41 million people have been successfully treated and up to 6 million lives saved through DOTS and the Stop TB Strategy. 5.8 million TB cases were notified through DOTS programs in 2009.

Emergence of antibiotic resistance

Antibiotics are drugs used for treating infections caused by bacteria. Misuse and overuse of these drugs, however, have contributed to a phenomenon known as antibiotic resistance. This resistance develops when potentially harmful bacteria change in a way that reduces or eliminates the effectiveness of antibiotics.

Antibiotic resistance is a growing public health concern worldwide. When a person is infected with an antibiotic-resistant bacterium, not only is treatment of that patient more difficult, but the antibiotic-resistant bacterium may spread to other people.

When antibiotics don't work, the result can be

- longer illnesses
- more complicated illnesses
- the use of stronger and more expensive drugs
- more deaths caused by bacterial infections

Examples of the types of bacteria that have become resistant to antibiotics include the species that cause skin infections, meningitis, sexually transmitted diseases and respiratory tract infections.

In cooperation with other government agencies, the Food and Drug Administration (FDA) has launched several initiatives to address antibiotic resistance. The agency has issued drug labeling regulations, emphasizing the prudent use of antibiotics. The regulations encourage health care professionals to prescribe antibiotics only when clinically necessary, and to counsel patients about the proper use of such drugs and the importance of taking them as directed. FDA has also encouraged the development of new drugs, vaccines, and improved tests for infectious diseases.

Current issues of MDR/XDR microbial strains

Multi-drug-resistant tuberculosis (MDR-TB) is a form of tuberculosis (TB) infection caused by bacteria that are resistant to treatment with at least two of the most powerful first-line anti-TB medications (drugs), isoniazid and rifampin. MDR-TB can become resistant to the major second-line TB drug groups: quinolones (moxifloxacin, ofloxacin) and aminoglycoside. When MDR-TB is resistant to at least one drug from each group, it is classified as extensively drug-resistant tuberculosis:

There are several ways that drug resistance to TB, and drug resistance in general, can be prevented:

1. Rapid diagnosis & treatment of TB: One of the greatest risk factors for drug resistant TB is problems in treatment and diagnosis, especially in developing countries. If TB is identified and treated soon, drug resistance can be avoided.
2. Completion of treatment: Previous treatment of TB is an indicator of MDR TB. If the patient does not complete his/her antibiotic treatment, or if the physician does not prescribe the proper antibiotic regimen, resistance can develop. Also, drugs that are of poor quality or less in quantity, especially in developing countries, contribute to MDR TB.
3. Patients with HIV/AIDS should be identified and diagnosed as soon as possible. They lack the immunity to fight the TB infection and are at great risk of developing drug resistance.

Usually, multidrug-resistant tuberculosis can be cured with long treatments of second-line drugs, but these are more expensive than first-line drugs and have more adverse effects. The treatment and prognosis of MDR-TB are much more akin to those for cancer than to those for infection. MDR-TB has a mortality rate of up to 80 %, which depends on a number of factors, including

1. How many drugs the organism is resistant to
2. How many drugs the patient is given
3. Whether an injectable drug is given or not
4. The expertise and experience of the physician responsible
5. How co-operative the patient is with treatment
6. Whether the patient is HIV positive or not

Treatment using antiviral agents

Antiviral agents are most active when viruses are replicating. An important difficulty is that a substantial amount of viral multiplication has often taken place before symptoms occur. Apart from primary infection, viral illness is often the consequence of reactivation of latent virus in the body. Viruses are capable of developing resistance to antimicrobial drugs, with similar implications for the individual patient, for the community and for drug development.

(a) Amantadine: Amantadine, also called 1-adamantanamine hydrochloride, drug used to treat infections caused by influenza type A virus, the most common cause of influenza epidemics. Amantadine and its derivative, rimantadine, can be used successfully in the prevention and treatment of influenza A; however, these agents have no effect against influenza B viruses. Amantadine also has some ability to reduce symptoms of tremor and bradykinesia (slowness of movement) in patients affected by Parkinson disease.

In the treatment of influenza, amantadine acts by blocking uncoating of the virus within the cell, thus preventing the release of viral RNA into the host cell. Amantadine can also block the assembly of influenza virus during viral replication. In the treatment of Parkinson disease, amantadine appears to work through multiple mechanisms. The drug can stimulate the release of dopamine from certain cells in the brain and can block the receptors of excitatory molecules involved in causing over activity of neurons that control movement.

Administration of amantadine may cause gastrointestinal upset. The drug also may have minor effects on the central nervous system, resulting in dizziness, confusion, nervousness, anxiety, agitation, skin rashes, insomnia, difficulty in concentrating, and exacerbations of pre-existing seizure disorders and psychiatric symptoms in patients with schizophrenia or Parkinson's disease.

(b) Aciclovir: Aciclovir (ACV), also known as acyclovir, is an antiviral medication. It can be taken by mouth, applied as a cream, or injected. The discovery of aciclovir was announced in 1977. Aciclovir is excreted in the breast milk, therefore it is recommended that caution should be used in breast-feeding women. Aciclovir is used for the treatment of herpes simplex virus and varicella zoster virus infections, including:

- Genital herpes simplex (treatment and prevention)
- Neonatal herpes simplex
- Herpes simplex labialis (cold sores)
- Acute chickenpox in immunocompromised patients
- Herpes simplex encephalitis
- Acute mucocutaneous HSV infections in immunocompromised patients
- Herpes of the eye and herpes simplex blepharitis (a chronic (long-term) form of herpes eye infection)

Aciclovir is converted by viral thymidine kinase to aciclovir monophosphate, which is then converted by host cell kinases to aciclovir triphosphate (ACV-TP). ACV-TP, in turn, competitively inhibits and inactivates HSV-specified DNA polymerases preventing further viral DNA synthesis without affecting the normal cellular processes.

Common adverse drug reactions (≥1 % of patients) associated with systemic aciclovir therapy include nausea, vomiting, diarrhea, encephalopathy, injection site reactions and headache. In high doses, hallucinations have been reported. Infrequent adverse effects (0.1–1 % of patients) include agitation, vertigo, confusion, dizziness, oedema, arthralgia, sore throat, constipation, abdominal pain, hair loss, rash and weakness. Rare adverse effects (<0.1 % of patients) include coma, seizures, neutropenia, leukopenia, crystalluria, anorexia, fatigue, hepatitis, Stevens–Johnson syndrome, toxic epidermal necrolysis, thrombotic thrombocytopenic purpura and anaphylaxis.

(c) Azidothymidine: Zidovudine (ZDV), also known as azidothymidine (AZT), is an antiretroviral medication used to prevent and treat HIV/AIDS. Zidovudine was first described in 1964. It is generally recommended for use with other antiretrovirals. It may be used to prevent mother-to-child spread during birth or after a needle stick injury or other potential exposure. It is sold both by itself and together as lamivudine/zidovudine and abacavir/lamivudine/zidovudine. This approach is referred to as Highly Active Antiretroviral Therapy (HAART).

AZT is a thymidine analogue. AZT works by selectively inhibiting HIV's reverse transcriptase, the enzyme that the virus uses to make a DNA copy of its RNA. Reverse transcription is necessary for production of HIV's double-stranded DNA, which would be subsequently integrated into the genetic material of the infected cell (where it is called a provirus).

Most common side-effects include nausea, vomiting, acid reflux (heartburn), headache, cosmetic reduction in abdominal body fat, light sleeping, and loss of appetite. Less common side effects include faint discoloration of fingernails and toenails, mood elevation, occasional tingling or transient numbness of the hands or feet, and minor skin discoloration.

HAART

HAART is the acronym for "highly active antiretroviral therapy," a term coined in the late 1990s to describe the effectiveness of combination drug therapies used to treat HIV. Prior to HAART, the use of one or two antiretroviral drugs had generally limited success in patients with HIV, resulting in rapid treatment failure as well as the inability to fully suppress viral activity.

As opposed to single-drug or dual-drug therapies, the combination of three or more antiretroviral can work as a tag team, effectively suppress a wide variety of HIV that can exist within a single viral population. If one drug is unable to suppress a certain viral type, one or both of the other agent would be more than likely to do so. In turn, by keeping the viral population suppressed (undetectable), there are few circulating viruses in the bloodstream and few opportunities for the virus to mutate into a resistance strain.

Drugs Used in HAART: There are currently five classes of antiretroviral drug, each of which inhibits a specific stage in the HIV life cycle:

- entry or fusion inhibitors (which include CCR5 receptor antagonists)
- nucleoside and nucleotide reverse transcriptase inhibitors (NNRTI)
- non-nucleoside reverse transcriptase inhibitors (N/NRTI)
- integrase inhibitors
- protease inhibitors

Entry inhibitors: Entry inhibitors (or fusion inhibitors) interfere with binding, fusion and entry of HIV-1 to the host cell by blocking one of several targets. Maraviroc and enfuvirtide are the two currently available agents in this class. Maraviroc works by targeting CCR5, a co-receptor located on human helper T-cells. To prevent fusion of the virus with the host membrane, enfuvirtide can be used. Enfuvirtide is a peptide drug that must be injected and acts by interacting with the N-terminal heptad repeat of gp41 of HIV to form an inactive hetero six-helix bundle, therefore preventing infection of host cells.

Nucleoside/nucleotide reverse transcriptase inhibitors: Nucleoside reverse transcriptase inhibitors and nucleotide reverse transcriptase inhibitors (NNRTI) are nucleoside and nucleotide analogues which inhibit reverse transcription. NNRTIs are chain terminators such that once incorporated, work by preventing other nucleosides from also being incorporated into the DNA chain because of the absence of a 3' OH group. Both act as competitive substrate inhibitors.
Examples of currently used NNRTIs: Zidovudine, Abacavir, Lamivudine, Emtricitabine, and Tenofovir.

Non-nucleoside reverse transcriptase inhibitors: Non-nucleoside reverse transcriptase inhibitors (N/NRTI) inhibit reverse transcriptase by binding to an allosteric site of the enzyme; N/NRTIs act as non-competitive inhibitors of reverse transcriptase. N/NRTIs affect the handling of substrate (nucleotides) by reverse transcriptase by binding near the active site. Examples: Nevirapine, Efavirenz, Etravirine and Rilpivirine.

Integrase inhibitors: Integrase inhibitors (also known as integrase nuclear strand transfer inhibitors or INSTIs) inhibit the viral enzyme integrase, which is responsible for integration of viral DNA into the DNA of the infected cell. Examples: Raltegravir, Elvitegravir and Dolutegravir.

Protease inhibitors: Protease inhibitors block the viral protease enzyme necessary to produce mature virions upon budding from the host membrane. Virus particles produced in the presence of protease inhibitors are defective and mostly non-infectious.
Examples: Lopinavir, Indinavir, Nelfinavir, Amprenavir, Ritonavir, Darunavir and Atazanavir.

Unit- III; Possible Questions

Part-A (1 Mark)

Part-B (2 Mark)

1. What are beta lactam antibiotics? Give any two examples
2. Mention any two antifungal and antiparasitic agents
3. Expand DOTS and HAART
4. What are antiviral agents? Give any two examples
5. What are MDR and XDR strains?

Part-C (8 Mark)

1. Write a note on beta lactam antibiotics
2. Write a brief note on antiviral agents
3. Explain in detail
   (a) Concept of Dots
   (b) Concept of HAART
4. Write in details about antifungal and antiparasitic agents
5. Explain in details about judicious use of antibiotics and importance of completing antibiotic regimen
6. Write in details about the following antibiotics
   (a) Quinolones
   (b) Polypeptides
   (c) Aminoglycosides

KARPAGAM ACADEMY OF HIGHER EDUCATION

CLASS: III B.Sc MB COURSE NAME: Management of Human Microbial Diseases

COURSE CODE: 17MBU501A UNIT: III BATCH-2017-2020

Sl.No	Questions	Opt A	Opt B	Opt C	Opt D	Answer
1	Which of the following is an example of Polypeptide antibiotics?	Tetracycline	Colistin	Ciprofloxacin	Kanamycin	Colistin
2	Which of the following is an example of Aminoglycoside antibiotics?	Tetracycline	Colistin	Ciprofloxacin	Kanamycin	Kanamycin
3	HAART is used to describe the effectiveness of combination drug therapies used to treat _____.	Tuberculosis	Cancer	Ebola	AIDS	AIDS
4	DOTS is the name given to the _____ control strategy recommended by the World Health Organization.	Tuberculosis	Cancer	Ebola	AIDS	Tuberculosis
5	Which of the following is a anti parasitic agents: (i) Imidazole (ii) Anticestodes (iii) Allylamines (iv) Antiprotozoals?	(i) and (ii)	(ii) and (iv)	(iii) and (iv)	(i) and (iii)	(ii) and (iv)
6	_____is an active component in penicillin antibiotics.	δ-lactam	α-lactam	β-lactam	None of the above	δ-lactam
7	Which of the following is NOT a natural penicillin?	Penicillin S	Penicillin N	Penicillin V	Penicillin K	Penicillin S
8	Which of the following a antifungal agents? (i) Imidazole (ii) Aciclovir (iii) Allylamines (iv) Amantadine	(i) and (ii)	(ii) and (iv)	(iii) and (iv)	(i) and (iii)	(i) and (iii)
9	MDR/XDR microbial strains are commonly related to _____ sp.	*Mycobacterium*	*Klebsiella*	*Listeria*	*Neisseria*	*Mycobacterium*
10	Most β-lactam antibiotics work by inhibiting _____ biosynthesis in the bacterial organism.	Protein	Cell wall	DNA/RNA	All the above	Cell wall

11	Penicillin was discovered in ____ by Scottish scientist Alexander Fleming.	1927	1925	1929	1928	1928
12	Penicillin G is given _____.	intravenous use	Orally	Intramuscular	All the above	Intravenous use
13	penicillin V is given _____.	Intravenously	Orally	Intramuscular	All the above	Orally
14	Procaine penicillin and benzathine penicillin are given _____.	Intramuscular use	Intravenously	Orally	All the above	Intramuscular use
15	The cephalosporins are originally derived from the fungus _____.	*Acremonium*	*Aspergillus*	*Penicillium*	None of the above	*Acremonium*
16	First-generation cephalosporins are active predominantly against _____ bacteria.	Gram-positive	Gram-negative	Both A and B	None of the above	Gram-positive
17	Cephalosporins antibiotics work by inhibiting synthesis of the _____ forming the bacterial cell wall	Lipopolysaccharide layer	Peptidoglycan layer	Both A and B	None of the above	Peptidoglycan layer
18	The final transpeptidation step in the synthesis of the peptidoglycan is facilitated by _____.	Penicillin-binding fatty acids	Penicillin-binding sugars	Penicillin-binding proteins	All the above	Penicillin-binding proteins
19	Beta-lactam antibiotics mimic the _____ thereby irreversibly inhibiting PBP crosslinking of peptidoglycan	D-Gly-D-Gly site	D-Gly-D-Ala site	D-Ala-D-Ala site	D-Ala-D-Gly site	D-Ala-D-Ala site
20	_____ are used in human and veterinary medicine to treat bacterial infections, as well as in animal husbandry	Cephalosporin	Quinolones	Polypeptide antibiotics	Aminoglycoside	Quinolones
21	Nearly all quinolone antibiotics in use are _____.	Fluoroquinolones	Polypeptide antibiotics	Aminoglycosides	Cephalosporins	Fluoroquinolones
22	Fluoroquinolones are often used for _____infections.	Respiratory	Genitourinary	Gastrointestinal	All the above	Genitourinary

23	_____are widely used in the treatment of hospital-acquired infections associated with urinary catheters	Polypeptide antibiotics	Aminoglycosides	Cephalosporins	Fluoroquinolones	Fluoroquinolones
24	_____ exert their antibacterial effect by preventing bacterial DNA from unwinding and duplicating	Quinolones	Polypeptide antibiotics	Aminoglycosides	Cephalosporins	Quinolones
25	_____ is also a target for a variety of quinolone-based drugs.	Helicase	Topoisomerase II	Ligase	All the above	*Topoisomerase II*
26	_____ antibiotics are a chemically diverse class of anti-infective and antitumor antibiotics containing non-protein polypeptide chains	Polypeptide	Aminoglycosides	Cephalosporins	Fluoroquinolones	Polypeptide
27	_____ highly toxic by the oral route.	Anidulafungin	Micafungin	Actinomycin-D	Caspofungin	Actinomycin-D
28	Streptomycin is the first-in-class aminoglycoside antibiotic and is derived from _____.	*P. chrysogenum*	*Lentinula edodes*	*Streptomyces erythreus*	*Streptomyces griseus*	*Streptomyces griseus*
29	_____is the earliest modern agent used against tuberculosis.	Streptomycin	Zidovudine	Tobramycin	Neomycin	Streptomycin
30	Aminoglycoside antibiotics display bactericidal activity against _____ aerobes and some anaerobic ____.	Gram-negative, bacilli	Gram-positive, cocci	Gram-negative, cocci	Gram-positive, bacilli	Gram-negative, bacilli
31	_____ can cause inner ear toxicity which can result in sensorineural hearing loss	Polypeptide antibiotics	Aminoglycoside	Cephalosporin	Quinolones	Aminoglycoside
32	An _____ medication, also known as an antimycotic medication.	Antiparasitic	Antibactiral	Antifungal	Antiviral	Antifungal

33	_____ may be used for systemic fungal infections in immunocompromised patients	Thiazole antifungals	Polyene antifungals	Echinocandins	Allylamines	Echinocandins
34	Echinocandins are poorly absorbed when administered _____.	Intravenously	Orally	Intramuscular	All the above	Orally
35	_____ is used for most nematode infections.	Eflornithine	Pyrantel pamoate	Mebendazole	Both B and C	Both B and C
36	_____ is used for treatment of Lymphatic filariasis.	Ivermectin	Praziquantel	Eflornithine	Diethylcarbamazine	Diethylcarbamazine
37	_____ is used for roundworm infections.	Thiabendazole	Praziquantel	Niclosamide	Amphotericin B	Thiabendazole
38	Directly observed treatment, short-course is the name given to the_____control strategy recommended by the World Health Organization	Pneumonia	Tuberculosis (TB)	Epiglottitis	Laryngotracheitis	Tuberculosis (TB)
39	The technical strategy for _____ was developed by Karel Styblo.	HAART	DOTS	Both A and B	None of the above	DOTS
40	DOTS have _____ main components.	3	4	9	5	5
41	Highly active antiretroviral therapy, a term coined in the late _____.	1990s	1980s	1970s	1960s	1990s
42	HAART describes the effectiveness of combination drug therapies used to treat _____.	HSV	HIV	HPV	TB	HIV
43	Currently __ classes of antiretroviral drug, each of which inhibits a specific stage in the HIV life cycl	3	4	5	9	5
44	Which one of the following is NOT a class used in HAART?	NRTI/NtRTI	NNRTI	Protease inhibitors	Rifampin	Rifampin

45	Which of the following drugs are used treat TB?	Metronidazole	Isoniazid and rifampin	Melarsoprol	Miltefosine	Isoniazid and rifampin
46	MDR-TB has a mortality rate of up to ____ %, which depends on a number of factors	80	70	60	50	80
47	_____is used for intestinal infections caused by *Giardia lamblia*.	Albendazole	Melarsoprol	Tinidazole	Miltefosine	Tinidazole
48	_____ is used for vaginitis caused by *Trichomonas*.	Metronidazole	Eflornithine	Nitazoxanide	Praziquantel	Metronidazole
49	_____ is used for treatment of sleeping sickness caused by *Trypanosoma brucei.*	Tinidazole	Nitazoxanide	Praziquantel	Melarsoprol	Melarsoprol
50	_____ is used for the treatment of visceral and cutaneous leishmaniasis.	Eflornithine	Miltefosine	Albendazole	Metronidazole	Miltefosine
51	_____ is used for prevention of river blindness.	Nitazoxanide	Praziquantel	Ivermectin	Rifampin	Ivermectin
52	Which one of the following is NOT an anticestodes?	Albendazole	Praziquantel	Niclosamide	Isoniazid	Isoniazid
53	_____ is used for the treatment of herpes simplex virus and varicella zoster virus infections	Zidovudine	Aciclovir	Amantadine	Lamivudine	Aciclovir
54	The discovery of aciclovir was announced in _____.	1977	1967	1988	1987	1977
55	Which one of the following is NOT major second-line TB drug groups?	Moxifloxacin	Amantadine	Ofloxacin	Capreomycin	Amantadine
56	Aciclovir is a nucleic acid analogue made from _____.	Adinosine	Cytosine	Guanosine	Thymidine	Guanosine
57	Which one of the following is NOT an antinematodes?	Amphotericin B	Mebendazole	Diethylcarbamazin	Thiabendazole	Amphotericin B
58	Cephalosporins are originally derived from	*Aspergillus*	*Penicillium*	*Acremonium*	None of the above	*Acremonium*

	the _____.					
59	_____ can be used successfully in the prevention and treatment of influenza A.	Rimantadine	Aciclovir	Zidovudine	Lamivudine	Rimantadine
60	_____ is the first-in-class aminoglycoside antibiotic	Gentamicin	Neomycin	Tobramycin	Streptomycin	Streptomycin

Unit IV

Syllabus

General preventive measures, Transmission and prevention of microbial diseases.Importance of personal hygiene, environmental sanitation and methods to prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors

Transmission and prevention of microbial diseases

- A person can transmit microbes to someone else through the air by sneezing or coughing. These are common ways to get viruses that cause colds or the flu, or the bacteria that causes tuberculosis. International airplane travel may expose a person to germs not common in their own nation. Other ways microbes are transmitted include:
- Shaking Hands or Touching Surfaces: It is possible for a person to pick up cold viruses by shaking someone's hand, or from touching surfaces that are contaminated such as a computer keyboard or a doorknob.
- Sexual Intercourse: Microbes such as herpes simplex virus type 2 which causes genital herpes, HIV, or *Neisseria gonorrhea* bacteria are examples of germs that a person may pass to someone else during sexual intercourse.
- Close Contact: Close contact may pass germs to another person. For example; through kissing. Scientists have identified more than 500 types of bacteria that live in people's mouths. Some keep the oral environment healthy, although others cause issues such as gum disease.
- Fecal Transmission: A common way for some microbes to enter a person's body, particularly when providing care for young children, is through passing feces from hand to mouth, or the mouths of young children. Infant diarrhea is often times spread in this manner. Daycare workers; for example, might pass diarrhea-causing rotavirus or *Giardia lamblia* from one child to another between diaper changes or other childcare practices.
- A person may catch a variety of germs from animals, particularly household pets. The rabies virus, which may infect dogs and cats, is one of the most serious and deadly of these microbes. Luckily, rabies vaccine prevents animals from getting rabies. Vaccines also protect people from getting the virus from an animal. Vaccines prevent people who have already been exposed to the virus from becoming ill through an animal bite, for example.
- Cat and dog saliva may contain any of more than 100 different germs that can make a person ill. 'Pasteurella,' bacteria is the most common type of germ and might be transmitted through bites that break a person's skin, causing serious and at times fatal diseases such as meningitis. Meningitis involves inflammation of the lining of a person's spinal cord and brain.
- It is important to note that warm-blooded animals are not the only ones that might cause a person harm. Pet reptiles such as snakes, turtles or iguanas may give Salmonella bacteria to their owners.
- Tiny Creatures and Microbe Transmission:
  Mosquitoes might be the most common carriers or, 'vectors,' of pathogens. Anopheles Plasmodium, which causes malaria, from the blood of one infected person might be transmitted to another person. Fleas that pick up Yersinia pestis bacteria from rodents may transmit plague to human beings. Ticks are another common vector. A deer tick might infect a person with *Borrelia burgdorferi*, the bacterium that causes Lyme disease. Ticks pick up this bacterium from mice.
  Microbe Transmission through Food or Water:
- Each year, millions of people around the world become ill from eating foods that are contaminated. While a number of instances of food-borne illness are not reported, the Centres for Disease Control and Prevention (CDC) estimates there are 76 million instances of such illness in America every year. The

CDC also estimates 325,000 people are hospitalized and 5,000 deaths are related to food-borne diseases each year. Microbes can cause these illnesses, some of which may be fatal if they are not treated appropriately.

- Poor food preparation or manufacturing processes can permit microbes to grow in food and go on to infect a person. Escherichia coli bacteria at times persist in food products such as unpasteurized fruit juice or undercooked meat. The bacteria may have fatal consequences in people who are vulnerable, particularly children and seniors.
- Cryptosporidia are bacteria found in human and animal feces. The bacteria may get into river, lake and ocean water through animal waste, sewage spills, or water runoff. Millions can be released from infectious fecal matter. People who swim in, drink from, or play in infected water may become ill. Adults and children with diarrhea caused by Cryptosprodia or other diarrhea-causing microbes such as Salmonella or Giardia may infect other people while using water-parks, swimming pools, spas, or hot tubs.
- Transplanted Animal Organs and Microbe Transmission:
  Transplanted animal organs might harbor germs. Researchers are investigating the potential for transplanting animal organs such as pig hearts into people. The researchers have to remain on-guard against the risk that the organs may also transmit microbes that were harmless to the animal into people where they may cause disease.

Microbial infection can be prevented by the following ways:

1. Clean Environment: In order to prevent microbial infection it is very important to maintain a clean environment. Cleanliness in the home and neighbourhood discourages the growth of microorganisms and their carriers (such as flies and mosquitoes).
2. Clean drinking water: Clean drinking water is very important for the prevention of microbial infections. Most of the surface and underground bodies of water are contaminated due to defecation in the open and seepage from sewers. As a result, a large number of our people constantly suffer from water-borne diseases. Therefore, drinking water should be properly treated and disinfected before consuming.
3. Body immunity system: The natural defences (immunity) of the body should be maintained in perfect order by keeping the body clean and by eating balanced food. Thus, personal hygiene and balanced diet are very important in preventing microbial infections.
4. Vaccination: Another powerful method, which can protect us from disease causing microorganism, is vaccination. Vaccines are available for many diseases, such as measles, polio, diphtheria, tetanus and thyroid. Since children are more susceptible to microbial infections, they should be immunized against the common microbial disease through vaccination. It is through extensive vaccination that smallpox has now been eradicated from the world.
5. Clean life: Many sexually transmitted diseases such as syphilis, gonorrhea and AIDS can be prevented by leading a clean life. Promiscuous, sexual behaviour can infect a person with any of these diseases.

The important steps for the prevention of microbial infection are summarized below:

1. Maintain a clean environment.
2. Keep garbage bins and food covered.
3. Use clean drinking water and protect the water bodies from contamination.
4. Maintain personal hygiene and eat balanced diet. This helps in keeping body's defence system strong.
5. Children may be immunised against common disease through vaccination.
6. Avoid promiscuous sexual behaviour and lead a healthy clean life.

Large number of these microbes resides in our body. These microbes, which reside in our body, are not harmful to it and our body has adopted them after a long process of microbe evolution to counter

infections caused by them. They rather help us in carrying out various body functions. For example, intestinal bacteria help in digestion of food. These various types of bacteria are present in skin, nasal passage, mouth, elementary canal and vagina.

Importance of personal hygiene

Maintaining personal hygiene is necessary for many reasons; personal, social, health, psychological or simply as a way of life. Keeping a good standard of hygiene helps to prevent the development and spread of infections, illnesses and bad odours.

1. Hair

Dirty head hair does not actually cause many health problems; it's mostly for appearance factor that keeping hair clean is a good idea.

Greasy hair - At some points of your life - especially in teenage years and at times of hormonal change, hair can become greasy more easily. There's really only one solution to greasy hair and that is to wash it, although some people find dry shampoo or talc helps to absorb some of the grease. If you're lucky enough to have hair long enough to tie up then you can miss a wash occasionally - those with natural blonde hair will find grease shows up more than on brunettes - it has to have some draw backs!

Dandruff - If you suffer from dandruff, try the various shampoos available. If it's serious there are some medical treaments available that are not harmful to the skin - those containing zinc pyritheone or selenium sulphide are said to be the most effective.

Head lice - Head lice are highly contagious. If left unattended, the lice grow large enough that you can actually see them moving(!) and the white eggs (nits) are also sometimes visible. You may also - but not always - experience itching. The best way to avoid persistent head lice is to wash your hair, leave a conditioner in and comb through with a fine tooth comb. Do this at least once a week, then even if a couple of lice manage to find their way to your lovely locks, they will not be given the chance to lay eggs and multiply

2. Teeth and Mouth

Teeth - A beautiful smile can make a person's day - but if teeth are grubby or breath is smelly, it has an entirely different result. Brush your teeth twice daily with a decent toothbrush (powered ones are best), a fluoride based toothpaste and an antibacterial mouthwash and you can't go far wrong. If you think your teeth are not white enough, try wearing different colours to make them seem brighter, avoid drinks such as tea, coffee and red wine, which are thought to stain them. If you're still convinced they're not white enough ask your dentist about treatments.

Smelly breath - Sometimes, despite good brushing a tooth will succomb to decay - if left untreated this can spread and infect your gums. Bad breath can be the sign of a gum infection. Make sure you vist your dentist regularly to keep a check on it. Halitosis (bad breath) can also be a result of dehydration or an empty stomach, so eat and drink regularly.

3. Areas Prone to Odour and Fungal Infection

Unpleasant smells and fungal infections are most commonly experienced in areas of the body that are warm and not often exposed to fresh air: the feet; the genitals and some of our sweat glands.

Smelly Feet - The feet contain lots of sweat glands. If feet are confined in socks and shoes the sweat has nowhere to 'evaporate' and the skin bacteria will in effect attack to, causing that pungent'cheesy' aroma. Here are some measures you can take to minimise smelly feet:

- Wash regularly and dry thoroughly with a soft towel and an anti-bacterial foot powder or a baby talc
- Allow feet to air when feasible and wear open shoes as much as possible
- Change socks more than once a day if needed and make sure they are cotton or other breathable fabric

Athlete's foot - Athlete's foot is a fungal infection that causes itching, flaky skin and sometimes a sore, red rash. It's highly contagious and can be unsightly. There are plenty of products available to combat athlete's foot, but you should check with your pharmacist or GP if you are taking any other medicines, have certain medical conditions, or are buying for a child as some of the treatments contain steroids.

Genital Areas - Genital areas can be prone to bacterial infections and unpleasant aromas if not kept clean. Conversely though, too much cleaning with scented products or soaps can cause thrush - a yeast infection. The best hygiene for all the genital ares is to clean once or twice a day using mild soap and water

Personal hygiene may be described as the principle of maintaining cleanliness and grooming of the external body. People have been aware of the importance of hygiene for thousands of years. The ancient Greeks spent many hours Bathing, using fragrances and make up in an effort to beautify themselves and be presentable to others.

Personal Hygiene products are a billion dollar business in the commercial market, with many high profile celebrities endorsing products that aim to keep us looking our best. In fact, hygiene is actually a scientific study.

Environmental hygiene

Activities aimed at improving or maintaining the standard of basic environmental conditions affecting the well-being of people. These conditions include (1) clean and safe water supply, (2) clean and safe ambient air, (3) efficient and safe animal, human, and industrial waste disposal, (4) protection of food from biological and chemical contaminants, and (5) adequate housing in clean and safe surroundings.

Methods to prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors

Infectious diseases are transmitted from person to person by direct or indirect contact. Certain types of viruses, bacteria, parasites, and fungi can all cause infectious disease. Malaria, measles, and respiratory illnesses are examples of infectious diseases.

Simple preventative measures, such as frequent hand washing, can cut down on disease transmission.

Direct contact

Infectious diseases are often spread through direct contact. Types of direct contact include:

1. Person-to-person contact

Infectious diseases are commonly transmitted through direct person-to-person contact. Transmission occurs when an infected person touches or exchanges body fluids with someone else. This can happen before an infected person is aware of the illness. Sexually transmitted diseases (STDs) can be transmitted this way.

Pregnant women can also transmit infectious diseases to their unborn children via the placenta. Some STDs, including gonorrhea, can be passed from mother to baby during childbirth.

2. Droplet spread

The spray of droplets during coughing and sneezing can spread an infectious disease. You can even infect another person through droplets created when you speak. Since droplets fall to the ground within a few feet, this type of transmission requires close proximity.

Indirect contact

Infectious diseases can also be spread indirectly through the air and other mechanisms. For example:

1. Airborne transmission

Some infectious agents can travel long distances and remain suspended in the air for an extended period of time. You can catch a disease like measles by entering a room after someone with measles has departed.

2. Contaminated objects

Some organisms can live on objects for a short time. If you touch an object, such as a doorknob, soon after an infected person, you might be exposed to infection. Transmission occurs when you touch your mouth, nose, or eyes before thoroughly washing your hands.

Germs can also be spread through contaminated blood products and medical supplies.

3. Food and drinking water

Infectious diseases can be transmitted via contaminated food and water. *E. coli* is often transmitted through improperly handled produce or undercooked meat. Improperly canned foods can create an environment ripe for *Clostridium botulinum*, which can lead to botulism.

4. Animal-to-person contact

Some infectious diseases can be transmitted from an animal to a person. This can happen when an infected animal bites or scratches you or when you handle animal waste. The *Toxoplasma gondii* parasite can be found in cat feces. Pregnant women and people with compromised immune systems should take extra care (disposable gloves and good hand washing) when changing cat litter, or avoid it altogether.

5. Animal reservoirs

Animal-to-animal disease transmission can sometimes transfer to humans. Zoonosis occurs when diseases are transferred from animals to people. Zoonotic diseases include:

- anthrax (from sheep)
- rabies (from rodents and other mammals)
- West Nile virus (from birds)
- plague (from rodents)

6. Insect bites (vector-borne disease)

Some zoonotic infectious agents are transmitted by insects, especially those that suck blood. These include mosquitos, fleas, and ticks. The insects become infected when they feed on infected hosts, such as birds, animals, and humans. The disease is then transmitted when the insect bites a new host. Malaria, West Nile virus, and Lyme disease are all spread this way.

7. Environmental reservoirs

Soil, water, and vegetation containing infectious organisms can also be transferred to people. Hookworm, for example, is transmitted through contaminated soil. Legionnaires' disease is an example of a disease that can be spread by water that supplies cooling towers and evaporative condensers.

Prevention of disease transmission

Infectious diseases can spread through direct or indirect contact, everyone is at risk of illness.

1. Illness

Something as simple as touching a doorknob, elevator button, light switch, or another person's hand increases the likelihood of coming in contact with germs that can make you sick. The good news is that a few simple precautions can prevent some disease transmission. For example, make sure you wash your hands frequently and thoroughly. Use soap and warm water and vigorously rub your hands together for at least 20 seconds. If you can't wash your hands, use an alcohol-based hand sanitizer. Washing your hands is the gold standard though!

Other tips to prevent the spread of disease in areas with germs include:

- wash your hands or use hand sanitizer before handling food and after shaking hands
- always wash with soap and water if your hands are visibly soiled
- try to minimize touching your mouth or nose with your hands
- avoid sick people, if possible
- wear disposable gloves to avoid contact with blood and feces
- use disposable gloves when caring for an ill person

- cover your mouth when you sneeze and cough and wash your hands afterward
- teach children not to put their hands or objects in their mouths
- sanitize toys and changing tables

2. Foodborne illness

Dangerous organisms can thrive in improperly prepared food. Avoid cross-contamination by keeping raw meats and produce separate. Use different preparation surfaces for raw meats and wash surfaces and utensils thoroughly.

Freeze or refrigerate perishable foods and leftovers promptly. According to the United States Department of Agriculture, you should set your refrigerator to 40°F (4°C) or below and your freezer to 0°F (-18°C) or below. Cook meats to a minimum internal temperature of 145°F (63°C). Cook ground meats to 160°F (71°C) and poultry to 165°F (73°C).

Be careful about sources of food when visiting foreign countries.

3. Insects and animals

When camping or enjoying wooded areas, wear long pants and long sleeves. Use insect repellent and mosquito netting. Don't touch animals in the wild. Don't touch sick or dead animals.

4. Vaccinations

Stay up to date on vaccinations, especially when traveling. Don't forget to keep your pet's vaccinations current, too.

Vaccinations can drastically reduce your risk of becoming ill with some infectious diseases. If you can avoid a particular disease, you can also prevent the spread of the disease. There are different types of vaccinations, such as those to prevent:

- measles
- mumps
- influenza
- human papillomavirus

Unit- IV; Possible Questions

Part-A (1 Mark)

Part-B (2 Mark)

1. What is sanitation and hygiene?
2. What are the infectious agents transmitted by food and water
3. Define transmission and prevention
4. Mention the routes of infection
5. What are the infectious agents transmitted by direct contact and insect vector

Part-C (8 Mark)

1. Write a note on importance of personal hygiene and environmental sanitation
2. Explain details about the methods to prevent the spread of infectious diseases
3. What are the general preventive measures for infectious diseases
4. Write a note on transmission and prevention of microbial diseases

KARPAGAM ACADEMY OF HIGHER EDUCATION

CLASS: III B.Sc MB COURSE NAME: Management of Human Microbial Diseases

COURSE CODE: 17MBU501A UNIT: IV BATCH-2017-2020

Sl.No	Questions	Opt A	Opt B	Opt C	Opt D	Answer
1	Diarrhea-causing ____ from one child to another between diaper changes or other childcare practices	Rotavirus	*Giardia lamblia*	Both A and B	None of the above	Both A and B
2	An incubation for common cold is _____h.	48 to 72	24 to 72	24 to 48	48 to 96	48 to 72
3	_____ is the causative agent of peptic ulcers in humans	*L. monocytogenes*	*H. pylori*	*Rota* virus	*Y. enterocolitica*	*H. pylori*
4	The causative agent of Candidiasis and Trichomoniasis a _____ respectively	*Trichomonas* sp. and *Candida sp*	*Trichomonas* sp. and *Chlamydia* sp	*Candida sp.* and *Trichomonas* sp.	*Candida sp.*and *Chlamydia* sp.	*Candida sp.* and *Trichomonas* sp.
5	Human African Trypanosomiasis is a microbial diseases associated with _____.	Eyes	Nervous system	Kidneys	Lungs	Nervous system
6	_____ is the causative agent of Dental caries.	*S. sonnei*	*S. mutans*	*S. dysenteriae*	*S. flexneri*	*S. mutans*
7	_____ is the incubation period of Rabies	2 to 3 days	2 to 7 days	1 to 3 days	4 to 8 days	1 to 3 days
8	_____ is reffered as genital herpes	HSV-1	HSV-2	Both A and B	None of the above	HSV-2
9	Syphilis is a sexually transmitted infection caused by the bacterium _____.	*Treponema pallidum*	*Treponema carateum*	*Treponema azotonutricium*	*Treponema pectinovorum*	*Treponema pallidum*
10	Chancroid is a sexually transmitted infection caused by the bacterium _____.	*Treponema pallidum*	*Haemophilus ducreyi*	*Neisseria gonorrhoeae*	*Chlamydia trachomatis*	*Haemophilus ducreyi*
11	which of the following mosquitoe borne diseases is sexually transmitted?	Chikungunya fever	Zika virus disease	Dengue fever	Yellow fever	Zika virus disease
12	_____, bacterium has only recently been identified as a sexually transmitted infection (STI).	Lymphogranuloma Venereum	Mycoplasma Genitalium	*Haemophilus ducreyi*	None of the above	Mycoplasma Genitalium
13	_____ is reffered as oral herpes	HSV-1	HSV-2	Both A and B	None of the above	HSV-1
14	Impetigo is caused by _____.	*Streptococcus pyogenes*	*Mycobacterium leprae*	*Trichophyton mentagrophytes*	*Microsporum canis*	*Streptococcus pyogenes*

15	In of the cases, cervical cancer can be attributable to ____ infection.	HPV	HIV	Hepatitis B	HSV	HPV
16	Improperly canned foods can create an environment ripe for *Clostridium botulinum*, which can lead to _____.	Botulism	Tetanus	Both A and B	None of the above	Both A and B
17	_____ are infectious diseases naturally transmitted from animals to humans	Brucellosis	Toxocariasis	Sparganosis	Zoonoses	Zoonoses
18	Community-acquired pneumonias caused by _____.	*Yersinia pestis*	*Staphylococcus aureus*	*Francisella tularensis*	*Pseudomonas aeruginosa*	*Staphylococcus aureus*
19	The causative agent of Dengue fever is_____.	*Flavivirus*	Zika virus	*Alphavirus*	None of the above	*Flavivirus*
20	_____ is the incubation period of *C. tetani.*	7 to 10 days	2 to 21 days	7 to 21 days	4 to 30 days	7 to 21 days
21	*Anopheles* mosquitoes spread _____.	Chikungunya	Dengue	Both A and B	Malaria	Both A and B
22	Shingles and Impetigo are the microbial diseases associated with _____.	Eyes	Nervous system	Kidneys	Skin	Skin
23	Transfusion of infected blood is main reason for spread of diseases like _____.	AIDS	Polio	Hepatitis B	Both A and C	Both A and C
24	_____ among persons who work in the poultry industry and information technology	Overuse syndrome	Computer vision syndrome	Carpal tunnel syndrome	Lead poisoning	Carpal tunnel syndrome
25	_____ affecting workers in many industries that processed or employed lead or lead compounds	Overuse syndrome	Computer vision syndrome	Carpal tunnel syndrome	Lead poisoning	Lead poisoning
26	Staphylococcal scalded skin syndrome is caused by _____.	*Clostridium difficile*	*K. pneumonia*	*P. aeruginosa*	*S. aureus*	*S. aureus*
27	A hospital acquired infection is called _____.	Familial	Potential	Genial	Nosocomial	Nosocomial
28	The infectious agent of Cat scratch disease is _____	*Borrelia sp.*	*Giardia*	*Bartonella sp.*	*T. gondii*	*Bartonella sp.*
29	The infectious agent of Lyme disease is	*Borrelia sp.*	*Giardia*	*Bartonella sp.*	*T. gondii*	*Borrelia sp.*

	_____.					
30	Chagos disease is caused by _____.	*Giardia*	*Bartonella sp.*	*T. gondii*	*Trypanosoma cruzi*	*Trypanosoma cruzi*
31	A deer tick might infect a person with _____, the bacterium that causes Lyme disease	*Borrelia sp.*	*Giardia*	*Bartonella sp.*	*T. gondii*	*Borrelia sp.*
32	Common reservoirs for _____ contamination are person to person, environment or contaminated water and food	*P. aeruginosa*	*C. difficile*	*E. coli*	*K. pneumonia*	*E. coli*
33	Toxic shock syndrome is caused by _____.	*Clostridium difficile*	*K. pneumonia*	*P. aeruginosa*	*S. aureus*	*S. aureus*
34	Common reservoirs for _____ contamination include breast pumps, incubators, sinks and hands of hospital staff and hand soaps	*P. aeruginosa*	*C. difficile*	*E. coli*	*K. pneumonia*	*P. aeruginosa*
35	MDR-TB has a mortality rate of up to ____ %, which depends on a number of factors	80	70	60	50	80
36	_____ is used for the treatment of herpes simplex virus and varicella zoster virus infections	Zidovudine	Aciclovir	Amantadine	Lamivudine	Aciclovir
37	The discovery of aciclovir was announced in _____.	1977	1967	1988	1987	1977
38	Penicillin was discovered in ____ by Scottish scientist Alexander Fleming.	1927	1925	1929	1928	1928
39	Penicillin G is given _____.	intravenous use	Orally	Intramuscular	All the above	Intravenous use
40	penicillin V is given _____.	Intravenously	Orally	Intramuscular	All the above	Orally
41	Procaine penicillin and benzathine penicillin are given _____.	Intramuscular use	Intravenously	Orally	All the above	Intramuscular use
42	The cephalosporins are originally derived from the fungus _____.	*Acremonium*	*Aspergillus*	*Penicillium*	None of the above	*Acremonium*

43	Nearly all quinolone antibiotics in use are _____.	Fluoroquinolones	Polypeptide antibiotics	Aminoglycosides	Cephalosporins	Fluoroquinolones
44	Fluoroquinolones are often used for _____infections.	Respiratory	Genitourinary	Gastrointestinal	All the above	Genitourinary
45	_____is an active component in penicillin antibiotics.	δ-lactam	α-lactam	β-lactam	None of the above	δ-lactam
46	Vaccination was invented by _____.	Edward Jenner	Louis Pasteur	Robert Koch	Salk	Edward Jenner
47	_____ type of vaccines are incapable of causing a disease.	Inactivated vaccines	DNA vaccine	Both A and B	None of the above	Both A and B
48	The first dose of HpA is given at the age of _____.	1 year	4 years	7 years	9 years	1 year
49	BCG vaccine is given at _____.	4 weeks	8 weeks	12 weeks	Birth	Birth
50	Salk vaccine is administered _____.	Intramuscular	Orally	Intravenous	None of the above	Orally
51	The first dose of RV is given at the age of _____.	6 weeks	10 weeks	14 weeks	18 weeks	6 weeks
52	_____ vaccine is under developmental stage against Ebola	rVSV-BOV	rVSV-ZEV	rV-ZEBOV	rVSV-ZEBOV	rVSV-ZEBOV
53	_____vaccine is used against yellow fever.	YF 17C	YF 17D	YF 15C	YF 17C	YF 17D
54	DT vaccine is given against _____ sp.	*Clostidium*	*Mycobactium*	*Klebsiella*	*Varicella*	*Clostidium*
55	BCG vaccine is given at _____.	4 weeks	8 weeks	12 weeks	Birth	Birth
56	PCV vaccine is given against _____ disease.	Pneumonia	Tetanus	Diphtheria	Hepatitis B	Pneumonia
57	MMR vaccine is given agaisnt _____.	Measles	Mumps	Rubella	All the above	All the above
58	Hepatitis B causes a serious _____ disease.	Kidney	Liver	Lungs	Brain	Liver
59	Vaccine used against *H. influenza* is _____	DTP vaccine	Salk vaccine	Hib vaccine	HPV vaccine	Hib vaccine
60	Hepatitis B causes a serious _____ disease.	Kidney	Liver	Lungs	Brain	Liver

Unit V

Syllabus

Importance, types, Vaccine preparation, synthetic or recombinant vaccines.vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in the Indian context.

Vaccine and vaccination

A vaccine is a biological preparation that provides active acquired immunity to a particular disease. A vaccine typically contains an agent that resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbe, its toxins, or one of its surface proteins. The administration of vaccines is called vaccination. Vaccination is the most effective method of preventing infectious disease.

While Edward Jenner is commonly considered the inventor of the first vaccine – he used material from cowpox pustules as an immunization for smallpox. French researcher Albert Calmette and veterinarian Jean-Marie Camille Guérin accomplished to attenuate the bacterium causing tuberculosis.

After years of experimentation, an effective mixture between diphtheria toxin and antitoxin was developed by William H. Park and started to be used as immunization in 1914. The antibodies of measles were identified in 1916 by French researchers Charles Nicolle and Ernest Conseil. In 1918, the Vaccine Institute in Pairs developed freeze-dried vacuum smallpox vaccines that were to be used in the tropical French colonies.

Veterinarian Gaston Ramon and physician Alexander Thomas Glenny independently developed diphtheria toxoid in 1923. In 1931, American researcher Margaret Pittman classified different types of *Haemophilus influenzae* bacteria and found that the type b strain caused nearly all cases of *Haemophilus influenza* meningitis. American bacteriologist Pearl Kendrick and her colleague Grace Elderding published an article about the effectiveness of the pertussis (whooping cough) vaccine in 1939.

The first influenza vaccine was approved for military use in the United States in 1945 and civilian use in 1946. Around the same time, the pneumococcal vaccine was developed, but largely ignored due to the widespread use of penicillin against pneumococcal infections. The first combined DTP (diphtheria, tetanus, and pertussis) vaccines became available in the United States in 1948.

In 1960, Sabin's oral polio vaccine was licensed in the United States. In 1962, Maurice Hilleman and colleagues developed an attenuated measles vaccine, which was licensed the following year. In 1968, Hillman's team developed a new attenuated measles vaccine. His rubella vaccine was licensed in 1969. In 1971, the measles, mumps and rubella vaccine became licensed. The same year, a new inactivated rabies vaccine was developed.

The swine flu vaccine was developed in 1976, after a swine flu outbreak in New Jersey. The following year, the FDA licensed Hilleman's human-blood-derived hepatitis B vaccine, Heptavax-B. It was the first subunit viral vaccine developed in the United States. The first vaccine against *Haemophilus influenzae* type b (Hib) disease was licensed in the United States in 1985. Two years later, a conjugated Hib vaccine was licensed. First developed in 1975, the Ty21a oral typhoid vaccine was licensed for use in the United States 1989.

Vaccines preparation:

The production of a vaccine can be divided into following steps:

1. Generation of the antigen

The first step in order to produce a vaccine is generating the antigen that will trigger the immune response. For this purpose the pathogen's proteins or DNA are grown and harvested using the following mechanisms:

- Viruses are grown on primary cells such as cells from chicken embryos or using fertilised eggs (e.g. influenza vaccine) or cell lines that reproduce repeatedly (e.g. hepatitis A)
- Bacteria are grown in bioreactors that uses a particular growth medium that optimises the production of the antigens
- Recombinant proteins derived from the pathogen can be generated either in yeast, bacteria or cell cultures.

2. Release and isolation of the antigen

The aim of second step is to release virus or bacteria. To achieve this, the antigen is separated from the cells and isolated from the proteins and the growth medium.

3. Purification

In a third step, the antigen is purified in order to produce a high quality product.

Several separation steps are employed for protein purification considering differences in the following factors such as protein size, physico-chemical properties, binding affinity or biological activity.

4. Addition of other components

The fourth step may include the addition of an adjuvant, which is a material that enhances the recipient's immune response to a supplied antigen. The vaccine is then formulated by adding stabilizers to prolong the storage life or preservatives to allow multi-dose vials to be used safely as needed.

5. Packaging

Finally, all components that constitute the final vaccine are combined and mixed uniformly in a single vial or syringe and it is sealed with sterile stoppers. All the processes described above have to comply with the standards defined for Good Manufacturing Practices that will involve several quality controls and an adequate infrastructure and separation activities to avoid cross-contamination. Finally, the vaccine is labelled and distributed worldwide.

Types of vaccines:

- Live, attenuated vaccines
- Inactivated vaccines
- Subunit vaccines
  - Toxoid vaccines
  - Conjugate vaccines
- DNA vaccines
- Recombinant vector vaccines

Live, attenuated vaccines: Live vaccines use a weakened (or attenuated) form of the microbe that causes a disease. Because these vaccines are so similar to the natural infection that they help prevent, they create a strong and long-lasting immune response.

Live, attenuated vaccines are relatively easy to create for certain viruses. Vaccines against measles, mumps, and chickenpox, for example, are made by this method. Viruses often are attenuated through a method of growing generations of them in cells in which they do not reproduce very well.

Live, attenuated vaccines are more difficult to create for bacteria. Bacteria have thousands of genes and thus are much harder to control. Scientists working on a live vaccine for a bacterium, however, might be able to use recombinant DNA technology to remove several key genes.

Examples of live attenuated vaccines include:

- Viral: measles vaccine, mumps vaccine, rubella vaccine, live attenuated influenza vaccine, chicken pox vaccine, smallpox vaccine, oral polio vaccine (Sabin), rotavirus vaccine, and yellow fever vaccine.
- Bacterial: BCG vaccine, oral typhoid vaccine and epidemic typhus vaccine.

Advantages: Activates all phases of the immune system (for instance IgA local antibodies are produced); Provides more durable immunity; boosters are required less frequently; Low cost; Quick immunity; Some are easy to transport/administer (for instance OPV for polio can be taken orally, rather than requiring a sterile injection by a trained healthworker, as the inactivated form IPV does); Vaccines have strong beneficial non-specific effects. That is effects which go beyond the specific protective effects against the targeted diseases.

Disadvantages: Secondary mutation can cause a reversion to virulence; Can cause severe complications; in immunocompromised patients; Some can be difficult to transport due to requirement to maintain conditions (*e.g.* temperature)

2. Inactivated Vaccines: An inactivated vaccine (or killed vaccine) is a vaccine consisting of virus particles or bacteria that have been grown in culture and then killed using a method such as heat or formaldehyde. Pathogens for inactivated vaccines are grown under controlled conditions and are killed as a means to reduce infectivity (virulence) and thus prevent infection from the vaccine.

Inactivated vaccines are further classified depending on the method used to inactivate the virus. Whole virus vaccines use the entire virus particle, fully destroyed using heat, chemicals, or radiation. Split virus vaccines are produced by using a detergent to disrupt the virus. Subunit vaccines are produced by purifying out the antigens that best stimulate the immune system to mount a response to the virus, while removing other components necessary for the virus to replicate or survive or that can cause adverse reactions.

Examples of inactivated vaccines include:

- Viral: polio vaccine (Salk vaccine) and influenza vaccine
- Bacterial: typhoid vaccine, cholera vaccine, plague vaccine, and pertussis vaccine

Advantages: No risk of reversion to pathogenicity; No risk of transmission; easily stored and transported

Disadvantages: Multiple doses required; poorly defined composition; mainly humoral responses; Adjuvants normally needed.

Subunit Vaccines: Instead of the entire microbe, subunit vaccines include only the antigens that stimulate the immune system. In some cases, these vaccines use epitopes—the very specific parts of the antigen that antibodies or T cells recognize and bind to. Because subunit vaccines contain only the essential antigens and not all the other molecules that make up the microbe, the chances of adverse reactions to the vaccine are lower.

Subunit vaccines can contain anywhere from 1 to 20 or more antigens. Subunit vaccines are produced by producing the antigen molecules from the microbe using recombinant DNA technology. Vaccines produced this way are called "recombinant subunit vaccines."

Advantages: Defined Composition; Various delivery systems available

Disadvantages: Antigens must be produced and purified by cultivation of a pathogen; multiple doses typically required; Adjuvant needed

Toxoid Vaccines: These vaccines are used when a bacterial toxin is the main cause of disease. Toxins are inactivated by treating them with formalin, a solution of formaldehyde and sterilized water. Such "detoxified" toxins, called toxoids, and are safe for use as vaccines. Vaccines against diphtheria and tetanus are examples of toxoid vaccines.

Conjugate Vaccines: Conjugate vaccines consist of antigens (polysaccharides or oligosaccharides) that are chemically coupled to a protein carrier (PC). Coupling of the saccharides to protein converts polysaccharides to T-dependent antigens, which elicit robust immune responses in infants and adults. These "glycoconjugate" vaccines elicit T-cell help for B-cells that produce IgG antibodies to the conjugated polysaccharide. Glycoconjugates thus induce PS-specific IgM-to-IgG switching, memory B-cell development, affinity maturation, and long-lived T-cell memory.

Examples: Vaccines against Herpes simplex virus type-2, *H. influenza* (Hib vaccine)

DNA Vaccines: DNA vaccine is composed of doxyibonuclic acid and encodes antigens. After administration of the DNA, antigens are produced and stimulate an immune response. A DNA vaccine against a microbe would evoke a strong antibody response to the free-floating antigen secreted by cells, and the vaccine also would stimulate a strong cellular response against the microbial antigens displayed on cell surfaces. The DNA vaccine couldn't cause the disease because it wouldn't contain the microbe, just copies of a few of its genes. So called naked DNA vaccines consist of DNA that is administered directly into the body. These vaccines can be administered with a needle and syringe or with a needle-fewer devices that uses high-pressure gas to shoot microscopic gold particles coated with DNA directly into cells. Sometimes, the DNA is mixed with molecules that facilitate its uptake by the body's cells. Naked DNA vaccines being tested in humans include those against the viruses that cause influenza and herpes.

Examples: Malaria vaccine, influenza vaccine and Herpes virus vaccine

Advantages: Low intrinsic immunogenicity of nucleic acids; Induction of long term immune responses; Induction of both humoral and cellular immune responses; Possibilities of constructing multiple epitope plasmids; Heat stability; Ease of large scale production and inexpensive to design and produce.
Disadvantages: Effects of long term expression unknown; Formation of anti nucleic acid antibodies possible; Possible integration of the vaccine DNA into host genome; Concept restricted to peptide and protein antigens

Recombinant Vector Vaccines: Vaccines that are made available for administration in combination with recombinant vectors can be termed as recombinant vector vaccines. These vaccines involve the introduction of vaccine component into a recombinant vector, to prevent the degradation of vaccine component if susceptible for such degradation. Recombinant Vaccinia Virus Vaccine is an example for recombinant vaccine. In this case, the inserted genetic material causes the bacteria to display the antigens of other microbes on its surface. In effect, the harmless bacterium mimics a harmful microbe, provoking an immune response.

Vaccines available against microbial diseases and vaccination schedule:

1. Tuberculosis (TB): The vaccine for TB is the BCG vaccine (Bacille Calmette Guerain – named after the people who developed it). This vaccine is prepared from an organism closely related to *Mycobacterium tuberculi* (the organism that causes TB). The vaccine organism has been cultured and recultured in a laboratory numerous times to make it weaker (attenuated). Unfortunately, the BCG vaccine does not confer great immunity against TB, but it does prevent some of the more dangerous forms (such as TB of the brain), especially in children.

2. Diphtheria: The vaccine for diphtheria contains an inactivated form of the diphtheria toxin. This toxin is responsible for many of the clinical features of diphtheria. The vaccinated host could still be infected by the organism (*Corynebacterium diphtheria)*, but the toxin would be neutralised by the antibodies, and the clinical symptoms of diphtheria would not appear. Anaphylaxis (severe allergic reaction) is the common side effect of vaccine.

3. Tetanus: Tetanus vaccine is also an inactivated form of the toxin produced by *Clostridium tetani*. As with diphtheria, the most important side-effect of the vaccine is anaphylaxis.

4. Pertussis (whooping cough): The vaccine for this condition composed of inactivated *Bordetella pertussis* organism. Most common side-effects include shock, uncontrollable crying and sometimes brain damage. Because of these side-effects, a new pertussis vaccine was developed that contains only a portion of the organism combined with inactivated pertussis toxin. This acellular vaccine preparation has been shown to be almost as effective as the traditional vaccine, and has fewer side-effects.

5. *Haemophilus influenzae* type B: *H. influenzae* type B is responsible for numerous infections – such as pneumonia, meningitis, ear infections, epiglottitis (severe inflammation and swelling of the epiglottis in the throat) – *H. influenzae* type B is commonly associated with severe infections in children (meningitis,

epiglottitis, pneumonia). The vaccine contains a portion of the organism cell wall attached to a protein carrier, which increases the immunogenicity. This vaccine has been shown to significantly reduce both death and disability due to invasive *Haemophilus* infections (especially *Haemophilus* meningitis).

6. Cholera: Caused by *V. cholerae*, is responsible for severe watery diarrhoea, and often occurs in epidemics. The currently available cholera vaccine is an inactivated vaccine containing whole *V. cholerae* organism, and its effectiveness is estimated at 50 %. Some of the newer vaccines consist of genetically modified organisms that cannot cause disease. These vaccines consist of live organisms that can be given orally and will stimulate immunity in the gut.

7. Typhoid: This is a potentially fatal infection caused by the organism *Salmonella typhi*. It is acquired by ingesting (swallowing) the organism in contaminated food or water. The older vaccines consist of killed organisms given by injection. Although this vaccine was effective, there were often side-effects. Therefore, a live attenuated strain of *S. typhi* was developed as a vaccine. This vaccine is given orally and is also effective, but without the side-effects. However, the safety of this vaccine in pregnant women and patients with weakened immune systems has not been established. A third vaccine (subunit vaccine) containing a portion of the organism's cell wall is also available, and is given by injection. Typhoid vaccines are not part of the routine immunisation schedule, but should be considered by people travelling to areas where clean food and/or water may not be available.

8. Streptococcus pneumonia: *S. pneumoniae* is a common cause of pneumonia as well as a common cause of meningitis in adults. Over 80 different serotypes (strains with slightly different surface antigens) exist. It would be very difficult to design a vaccine capable of inducing immunity to all of the serotypes, so vaccines have been developed against the serotypes most commonly responsible for infection. There is a 23-valent vaccine (i.e. it provides immunity against 23 of the serotypes), consisting of cell wall components. More recently, both 7- and 9-valent vaccines have been introduced. The advantage of these vaccines is that they are conjugate vaccines and thus stimulate more effective immunity.

9. Hepatitis A: Vaccine contains a minute amount of hepatitis A virus that has been chemically inactivated. It is given by injection, usually in two doses one month apart. Because hepatitis A tends to be a mild disease in children and does not cause permanent liver damage or become chronic, it is not currently considered a high enough health priority for routine vaccination of children in this country.

10. Hepatitis B: The hepatitis B vaccine contains only the viral surface antigen known as hepatitis B antigen (HBsAg for short). For one type of vaccine against hepatitis B, the surface antigen is obtained from the blood of people who are chronic carriers of the virus. This is the so-called "plasma-derived" hepatitis B vaccine. During preparation, the surface antigen is highly purified so that there is no risk of causing hepatitis B or other blood-borne infections. For the second type of vaccine, yeast is genetically engineered to produce hepatitis B surface antigen. The surface antigen is collected from the cultured yeast. This is the so-called "recombinant" hepatitis B vaccine. The vaccine is given by injection.

11. Varicella (chickenpox): The vaccine against chickenpox is a live, attenuated form of the chickenpox virus known as the "Oka strain". A small number of children may develop mild chickenpox after receiving the vaccine. The vaccine virus can be transmitted to other children not immune to varicella, who may similarly develop symptoms. There have been rare reported cases of severe side effects like encephalitis, ataxia (cerebellitis), and thrombocytopaenia (low blood platelets) after the vaccination.

12. Polio vaccine: There are two vaccines that protect against poliomyelitis, namely the inactivated poliovirus vaccine (IPV), known as the Salk vaccine, which is given by injection and the oral, live attenuated vaccine (OPV) which is administered orally. This is also called the Sabin vaccine.

Age (completed weeks/months/years)	Vaccines	Doses	Content Tag
Birth	Bacillus Calmette–Guérin	1	BCG
	Oral polio vaccine	1	OPV
	Hepatitis B	1	Hep -B
6 weeks	Diptheria, Tetanus and Pertussis vaccine	1	DTP
	Inactivated polio vaccine	1	IPV
	Hepatitis B	1	Hep -B
	Haemophilus influenzae type B	1	Hib
	Rotavirus vaccine	1	Rotavirus vaccine
	Pneumococcal conjugate vaccine	1	PCV
10 weeks	Diptheria, Tetanus and Pertussis vaccine	1	DTP
	Inactivated polio vaccine	1	IPV
	Haemophilus influenzae type B	1	Hib
	Rotavirus vaccine	1	Rotavirus vaccine
	Pneumococcal conjugate vaccine	1	PCV
14 weeks	Diptheria, Tetanus and Pertussis vaccine	1	DTP
	Inactivated polio vaccine	1	IPV
	Haemophilus influenzae type B	1	Hib
	Rotavirus vaccine	1	Rotavirus vaccine
	Pneumococcal conjugate vaccine	1	PCV
6 months	Oral polio vaccine	1	OPV
	Hepatitis B	1	Hep -B
9 months	Oral polio vaccine	1	OPV
	Measles, Mumps, and Rubella	1	MMR
9 – 12 months	Typhoid Conjugate Vaccine	1	Typhoid Conjugate Vaccine
12 months	Hepatitis A	1	Hep -A
15 months	Measles, Mumps, and Rubella	1	MMR
	Varicella 1	1	Varicella
	PCV booster	1	PCV
16 to 18 months	Diphtheria, Perussis, and Tetanus	1	DTP

	Inactivated polio vaccine	1	IPV
	Haemophilus influenzae type B	1	Hib
18 months	Hepatitis A	1	Hep -A
2 years	Booster of Typhoid Conjugate Vaccine	1	Typhoid Conjugate Vaccine
4 to 6 years	Diphtheria, Perussis, and Tetanus	1	DTP
	Oral polio vaccine	1	OPV
	Varicella 2	1	Varicella
	Measles, Mumps, and Rubella	1	MMR
10 to 12 years	Tdap/Td	1	Tdap
	Human Papilloma Virus	1	HPV

Unit- II; Possible Questions

Part-A (1 Mark)

Part-B (2 Mark)

1. What is vaccine?
2. Mention the types of vaccines
3. What is live, attenuated vaccines and mention the disadvantages
4. Define DNA and recombinant vector vaccines
5. What are the advantages of subunit, toxoid and conjugate vaccines?

Part-C (8 Mark)

1. Write a note on importance and types of vaccines
2. Write in detail about available vaccines against various microbial diseases
3. Write a note on vaccine preparation and vaccination schedule in the Indian context

KARPAGAM ACADEMY OF HIGHER EDUCATION

CLASS: III B.Sc MB COURSE NAME: Management of Human Microbial Diseases

COURSE CODE: 17MBU501A UNIT: V BATCH-2017-2020

Sl.No	Questions	Opt A	Opt B	Opt C	Opt D	Answer
1	Vaccination was invented by _____.	Edward Jenner	Louis Pasteur	Robert Koch	Salk	Edward Jenner
2	The first recombinant antigen vaccine approved for human use is _____.	Var vaccine	Hib vaccine	DPT vaccine	Hepatitis B vaccine	Hepatitis B vaccine
3	Which of the following is a polysaccharide vaccine?	Anthrax vaccine	Hib vaccine	Hepatitis A	Rabies vaccine	Hib vaccine
4	Plasmids encoding antigenic protein from a pathogen that is directly injected into the cells where it expresses constitute _____.	Inactivated Vaccines	Recombined vaccines	DNA vaccines	Subunit Vaccines	DNA vaccines
5	Which of the following is a vaccine against Lyssa viruses?	Anthrax vaccine	Hepatitis A vaccine	Hib vaccine	Rabies vaccine	Rabies vaccine
6	Which of the following vaccines is/are given by the intramuscular route?	Influenza	BCG	Cholera	Varicella	BCG
7	DT vaccine is given against _____ sp.	*Clostidium*	*Mycobactium*	*Klebsiella*	*Varicella*	*Clostidium*
8	Which of the following is an examples of inactivated vaccines.	HpA vaccine	HPV vaccine	Salk vaccine	MMR vaccine	Salk vaccine
9	BCG vaccine is given at _____.	4 weeks	8 weeks	12 weeks	Birth	Birth
10	PCV vaccine is given against _____ disease.	Pneumonia	Tetanus	Diphtheria	Hepatitis B	Pneumonia
11	Edward Jenner used material from cowpox pustules as an immunization for _____.	Chiken pox	Smallpox	Both A and B	None of the above	Smallpox
12	_____ accomplished to attenuate the bacterium causing tuberculosis.	Albert Calmette	Jean-Marie Camille Guérin	Both A and B	None of the above	Both A and B
13	In _____, the air-dried vaccine for smallpox was developed.	1919	1909	1910	1913	1909
14	The first dose of HpA is given at the age of _____.	1 year	4 years	7 years	9 years	1 year

15	_____ vaccine is under developmental stage against Ebola	rVSV-BOV	rVSV-ZEV	rV-ZEBOV	rVSV-ZEBOV	rVSV-ZEBOV
16	_____vaccine is used against yellow fever.	YF 17C	YF 17D	YF 15C	YF 17C	YF 17D
17	The first dose of RV is given at the age of _____.	6 weeks	10 weeks	14 weeks	18 weeks	6 weeks
18	In ___, Sabin's oral polio vaccine was licensed in the United States.	1962	1960	1966	1969	1960
19	MMR vaccine is given agaisnt _____.	Measles	Mumps	Rubella	All the above	All the above
20	Hepatitis B causes a serious _____ disease.	Kidney	Liver	Lungs	Brain	Liver
21	The first influenza vaccine was approved for civilian use in US in _____.	1944	1945	1946	1947	1946
22	Salk vaccine is administered _____.	Intramuscular	Orally	Intravenous	None of the above	Orally
23	_____ is also called the Sabin vaccine.	Var vaccine	Hib vaccine	Rabies vaccine	Salk vaccine	Salk vaccine
24	In _____, Maurice Hilleman developed an attenuated measles vaccine.	1960	1965	1969	1962	1962
25	In 1918**,** the Vaccine Institute in Pairs developed freeze-dried vacuum _____ vaccines.	BCG vaccine	Smallpox	Anthrax vaccine	MMR vaccine	Smallpox
26	In 1968, Hillman's team developed a new attenuated _____ vaccine.	Anthrax vaccine	MMR vaccine	Smallpox	Measles	Measles
27	The first dose of HPV is given at the age of _____.	1 year	4 years	7 years	9 years	9 years
28	The first vaccine against *Haemophilus influenzae* type b (Hib) disease was licensed in the United States in _____.	1981	1985	1995	1991	1985
29	Hib vaccine contains only the coat _____of the *Haemophilus influenzae* type B.	Amino acids	Proteins	Lipids	Fatty acids	Proteins

30	The DPT and DT vaccine is administered by _____ injection.	Intramuscular	Orally	Intravenous	None of the above	Intramuscular
31	In _____, Max Theiler and his colleagues developed a live attenuated vaccine for yellow fever	1935	1936	1937	1938	1936
32	DNA vaccines being tested in humans include those against the viruses that cause _____.	Influenza	Herpes	Both A and B	None of the above	Both A and B
33	_____ vaccine leaves a visible scar after administration.	Anthrax vaccine	MMR vaccine	BCG vaccine	Salk vaccine	BCG
34	_____ vaccine is an example for recombinant vaccine.	Recombinant HPV	Recombinant HIV	Recombinant Vaccinia Virus	Recombinant VaricellaVirus	Recombinant Vaccinia Virus
35	The antibodies of measles were finally identified in ___ by French researchers Charles Nicolle and Ernest Conseil.	1910	1912	1916	1914	1916
36	DNA vaccines are composed of DNA coated by _____.	Iron particles	Copper particles	Silver particles	Gold particles	Gold particles
37	_____ type of vaccines are incapable of causing a disease.	Inactivated vaccines	DNA vaccine	Both A and B	None of the above	Both A and B
38	The swine flu vaccine was developed in _____, after a swine flu outbreak in New Jersey.	1966	1976	1923	1967	1976
39	Viruses are grown on primary cells such as cells from _____ embryos or using fertilised eggs	Chicken	Duck	Bird	Both A and B	Chicken
40	_____ derived from the pathogen can be generated either in yeast, bacteria or cell cultures	Recombinant fatty acids	Recombinant proteins	Proteins	Fatty acids	Recombinant proteins
41	In _____, the Vaccine Institute in Pairs developed freeze-dried vacuum smallpox vaccines	1912	1914	1916	1918	1918
42	Vaccine used against *H. influenza* is _____	DTP vaccine	Salk vaccine	Hib vaccine	HPV vaccine	Hib vaccine
43	_____ was the first subunit viral vaccine	Heptavax-B	Heptavax-C	Heptavax-A	Heptavax-D	Heptavax-B

	developed in the United States					
44	Just _____doses of most live vaccines can give you a lifetime of protection against a germ and the disease it causes.	1 or 2	2 or 3	3 or 4	4 or 5	1 or 2
45	Which of the live, attenuated vaccines are example of following diseases?	Mumps	Measles	Chickenpox	All the above	All the above
46	Veterinarian Gaston Ramon and physician Alexander Thomas Glenny independently developed diphtheria toxoid in _____.	1919	1922	1923	1926	1923
47	Conjugate vaccines consist of antigens that are chemically coupled to a _____ carrier.	Amino acid	Protein	Fatty acid	Lipid	Protein
48	Conjugate vaccines uses antigens of _____ that are chemically coupled to a protein carrier (PC).	Polysaccharides	Oligosaccharides	Both A and B	None of the above	Both A and B
49	The first combined DTP vaccines became available in the United States in _____.	1948	1949	1950	1951	1948
50	Which of the following vaccine is NOT an inactivated vaccines?	DTP vaccine	Salk vaccine	HPV vaccine	Rabies vaccine	HPV vaccine
51	Kendrick and Elderding published an article about the effectiveness of the pertussis vaccine in _____.	1939	1938	1936	1931	1939
52	_____ type of vaccines use epitopes.	Conjugate vaccines	DNA vaccine	Toxoid vaccines	Subunit vaccines	Subunit vaccines
53	Subunit vaccines can contain anywhere from _____ antigens.	1 to 5	1 to 10	1 to 15	1 to 20	1 to 20
54	FDA licensed Maurice Hilleman's hepatitis A vaccine in _____.	1985	1989	1991	1995	1995
55	Which of the following vaccine used against	Salk vaccine	HPV vaccine	HpA vaccine	MMR vaccine	Salk vaccine

	Polio?					
56	An effective mixture between diphtheria toxin and antitoxin was developed by William H. Park and started to be used as immunization in ____.	1914	1918	1916	1912	1914
57	Bacterial toxin is treated with _____ to become toxoid.	Formaldehyde	Acetaldehyde	Benzaldehyde	All the above	Formaldehyde
58	Vaccines against _____ are examples of toxoid vaccines	Diphtheria	Tetanus	Both A and B	None of the above	Both A and B
59	Glycoconjugate vaccines have played a role in preventing infectious diseases caused by pathogens_____	*H. influenzae*	*Streptococcus pneumoniae*	*Neisseria meningitides*	All the above	All the above
60	The first influenza vaccine was approved for military use in the United States in _____. and civilian use in 1946	1944	1945	1946	1947	1945