

Semester IV

Medical Microbiology

Marks: 150

The Medical Microbiology course has been formulated to impart basic and medically relevant information on the microbes. The microbial structure, growth and development, methods and role of sterilization in the context of study of microbes are included. The pathogenic microbes and the diseases caused by them are included to broaden the perspective of the subject. This course will also focus on mechanisms of microbial pathogenesis and the host response, and the scientific approaches that are used to investigate these processes. Lastly the course deals with the problem of emerging antimicrobial resistance with reference to known pathogens.

THEORY

Total Lectures = 48

Unit I: Fundamental Concepts (Chapter 1, 6, 7, 8 and 17: Willey)

(8 Lectures)

- a) History of microbiology, Discovery of microorganisms, Contributions of Louis Pasteur and Robert Koch in Medical Microbiology.
- b) Molecular methods of assessing microbial phylogeny- molecular chronometer, phylogenetic trees, rRNA, DNA and proteins as indicator of phylogeny. Major Divisions of life-Domains, Kingdoms.
- c) Requirements for microbial growth, growth factors, culture media- synthetic and complex, types of media. Obtaining Pure Cultures, Preserving Bacterial Cultures, Growth Curves and generation time, Control of microbial growth, general concept of effect of environmental factors on growth of microbes.

Unit II: Bacterial Cells - fine structure and function. (Chapter 3: Willey)

(5 Lectures)

Size, shape and arrangement of bacterial cells. Cell membrane, cytoplasmic matrix, inclusion bodies (eg magnetosomes), nucleoid, Ultrastructure of Gram +ve and Gram -ve bacterial cell wall, Pili, Capsule, Flagella and motility

Unit III: Microbial Genetics (Chapter 14: Willey)

(5 Lectures)

Mutations, Bacterial recombination: general and site specific and replicative, bacterial plasmids fertility factor, col plasmid, bacterial conjugation (Hfr, F', F+, F-), transformation, transduction-generalized and specialized.

Unit IV: Principles of Diseases and Epidemiology (Chapter 14: Tortora)

(3 Lectures)

Relationship between Normal microbiota and host, Opportunistic microorganisms, nosocomial infections, Development and spread of infectious disease: invasion, pathogen, parasite,

pathogenicity, virulence, carriers and their types

Unit V: Bacterial Diseases (with reference to etiology, clinical symptoms, virulence factors involved, detection and prevention) (7 Lectures)
(Chapter 38: Willey)

Respiratory tract infections: Diphtheria and Tuberculosis, Gastrointestinal tract infections, staphylococcal food poisoning and *E. coli* gastroenteritis, Urinary tract infections: gonorrhea and syphilis

Unit VI: Viruses, viroids, prions (5 Lectures)
(Chapter 25 and 37: Willey)

General characteristics of viruses, structure, isolation, cultivation and identification of viruses, viral multiplication, one step multiplication curve, lytic and lysogenic phages (lambda phage), concept of early and late proteins, clinical virology with reference to HIV virus and hepatitis virus (Life cycle and clinical symptoms), viroids and prions

Unit VII: Medical Mycology (with reference to Life Cycle and clinical symptoms) (5 Lectures)
(Chapter 50: Forbes, Sahm and Weissfeld)

General and detailed life cycle of *Aspergillus* and *Candida albicans* in relation to human diseases caused by them.

Unit VIII: Parasitology (with reference to Life Cycle and clinical symptoms) (3 Lectures)
(Chapter 49: Forbes, Sahm and Weissfeld)

Classification of medically important parasites. Common protozoan disease: Malaria, Infections caused by *Taeniasolium* / *Taeniasaginata*, *Fasciola hepatica* and *Ascarislumbricoides*.

Unit IX: Antimicrobial chemotherapy and emerging antimicrobial resistance (7 Lectures)
(Chapter 34: Willey)

Spectrum of antimicrobial activity, action of antimicrobial drugs, inhibitors of cell wall synthesis, anti-mycobacterial antibiotics, inhibitors of protein synthesis and nucleic acid synthesis, competitive inhibitors of essential metabolites, antifungal, antiviral, anti-protozoan drugs; effectiveness of chemotherapeutic agents, concepts of antimicrobial resistance, novel methods to combat increasing antimicrobial resistance.

PRACTICALS

1. Preparation of different media: synthetic media, Complex media-nutrient agar, Luria Agar.
2. Staining methods: Gram's staining, Acid fast staining (permanent slide only), Capsule staining and spore staining.

3. Study and plot the growth curve of *E coli* using turbidometric method and to calculate specific growth rate and generation time.
4. To perform antibacterial testing by Kirby-Bauer method.
5. Staining and morphological characterization of *Aspergillus* sp., *Pencillium* sp. and *Saccharomyces* sp.
6. Demonstration of PCR based method of detection.
7. Isolation of bacteriophages (any with a non-pathogenic host) and calculation of the plaque forming units (pfu).

ESSENTIAL BOOKS

1. Microbiology: An Introduction, 9th edition (2008), Gerard J. Tortora, Berdell R. Funke, Christine L. Case; Benjamin Cummings.
2. Prescott, Harley, and Klein's Microbiology, 8th edition, (2011), Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw Hill International.
3. Bailey and Scott's Diagnostic Microbiology, 12th edition (2007), Betty A. Forbes, Daniel F. Sahm and Alice S. Weissfeld; Mosby Elsevier Publishers.

SUGGESTED READINGS

1. Microbiology, 6th edition (1993), Pelczar, Chan and Krieg; McGraw Hill International.
2. Brock Biology of Microorganisms, 13th edition (2010), Michael T. Madigan, John M. Martinko, David Stahl and David P. Clark, Pearson's, Benjamin Cummings.
3. Microbiology: A Laboratory Manual, 10th edition, (2013), James Cappuccino and Natalie Sherman, Benjamin Cummings.