

3. Microbiology: A Laboratory Manual by J. Cappuccino and C.T. Welsh. 11th edition. Pearson Education, USA. 2016.
4. Laboratory Manual on Immunology and Molecular Biology by D. Dwivedi and V. Singh. Lambert Academic Publishing, India. 2013.
5. Practical Immunology by F.C. Hay, M.R. Olwyn and M.R. Westwood. 4th edition. Wiley Blackwell Publishing. 2002.

### Suggestive readings

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

## DISCIPLINE SPECIFIC CORE COURSE –15: MEDICAL MICROBIOLOGY

### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
<b>MICROB-DSC503:</b>  <b>MEDICAL MICROBIOLOGY</b>	<b>4</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>Class XII pass with Biology/ Biotechnology/ Biochemistry</b>	<b>None</b>

### Learning Objectives

The Learning Objectives of this course are as follows:

- The main objective of this course is to introduce the students to the fundamental features of medical microbiology.
- Students will recognize the diversity of microbial pathogens and their virulence mechanisms. They will be introduced to specific infectious diseases of global relevance, diagnostic methods, and methods to manage infectious diseases.
- They will become familiar with the functional aspects of antimicrobial chemotherapy and anti- microbial resistance and will gain insights into the recent development of new molecular diagnostic methods as well as the global spread and emergence of infectious agents.

### Learning outcomes

The Learning Outcomes of this course are as follows:

- Student will be able to explain the terms in describing disease causalities, pathogenic features of microbial agents of disease, and their transmission, and will be able to describe the diverse nature of the human microbiome and its significance.
- Student will be able to describe the spectrum of diseases caused by bacterial pathogens, and the course of disease development and accompanying symptoms. Student will be able to discuss the methods of transmission, epidemiological aspects, preventive measures, treatments.
- Student will be able to explain the human diseases caused by viruses including emerging viral pathogens, giving an understanding of the etiology, course of disease development, symptoms, diagnosis and management of these diseases.
- Student will be able to elaborate on the fungal and protozoan diseases with respect to their etiology, symptoms, transmission, diagnosis and control.
- Student will be able to explain the basic concepts of handling clinical specimens, and approaches used to aid in detection/ diagnosis of infectious agents using immunological and molecular biology-based methods.
- Student will be able to evaluate the mode of action of different antimicrobial agents, concept of antimicrobial resistance and immunization schedule followed in India.

## SYLLABUS OF DSC-15

### UNIT – I (7 hours)

**Introduction to pathogenicity, infection and human microbiota:** Commonly used terms and nomenclature: pathogen, infection, invasion, virulence and its determinants, endotoxins and exotoxins, carriers and their types. Opportunistic, nosocomial, acute, latent and chronic infections. Sepsis and septic shock. Modes of transmission of pathogens. Role of microbiome in human health. Factors governing the microbiota of skin, throat and upper respiratory tract, gastrointestinal tract, urogenital tract (with examples of microorganisms in each instance).

### UNIT – II (12 hours)

**Bacterial pathogens causing common diseases in humans:** Symptoms, transmission, prophylaxis and treatment of the diseases caused by: *Bacillus anthracis*, *Clostridium tetani*, *Clostridium difficile*, *Escherichia coli*, *Helicobacter pylori*, *Mycobacterium tuberculosis*, *Staphylococcus aureus*, *Salmonella enterica* Typhi, *Treponema pallidum*, *Vibrio cholerae*

### Unit III: (12 hours)

**Viral diseases in humans:** Etiology, symptoms, transmission, diagnosis, prophylaxis, and treatment of the following diseases: Polio, Chicken pox, Mumps, Measles, Herpes, Hepatitis, Rabies, AIDS, Influenza (swine flu and bird flu), Dengue, Japanese Encephalitis, Rota virus infections, COVID-19.

#### **UNIT – IV (4 hours)**

**Protozoan and fungal diseases in humans:** Etiology, symptoms, transmission, diagnosis and control of Malaria and Kala azar. Types of mycoses. Detailed study of certain mycoses. Cutaneous mycoses: Tinea pedis (Athlete's foot). Systemic mycoses: Aspergillosis. Opportunistic mycoses: Candidiasis, Mucormycosis.

#### **UNIT – V (10 hours)**

##### **Diagnostics and therapeutics in infectious diseases:**

Collection, transport and culturing of clinical samples. Principles of different diagnostic tests: Agglutination-based tests (Widal and VDRL test), lateral flow assay-based kits, immunofluorescence test for syphilis, Nucleic acid based diagnostic techniques: Rapid PCR and RT-PCR.

**Anti-microbial chemotherapy:** General characteristics and mode of action of anti-microbial agents. Antibacterial with one example each: inhibitor of nucleic acid synthesis, inhibitor of cell wall synthesis, inhibitor of cell membrane function, inhibitor of protein synthesis. Antifungal: mechanisms of action of amphotericin B, griseofulvin. Antiviral: mechanism of action of amantadine, tamiflu, acyclovir. Antimicrobial resistance: mechanisms of drug resistance, MDR, XDR, TDR, NDM-1, ESBL, MRSA, VRSA, ESKAPE pathogens.

#### **Practical component**

##### **UNIT 1: (16 hours)**

**Identification and analysis of the cultural, morphological and biochemical characteristics of bacteria:** E. coli, Salmonella, Pseudomonas, Staphylococcus, Bacillus, Klebsiella (any three).

Study of the composition and use of important differential media for identification of bacteria: mannitol salt agar, deoxycholate citrate agar / Salmonella Shigella (SS) agar, MacConkey / EMB Agar.

Identification of bacteria based on biochemical characteristics: IMViC (Indole test, Methyl Red test, Voges-Proskauer test, Citrate test), Triple Sugar Iron (TSI) test, nitrate reduction test, urease test and catalase test.

Group project: Study of skin microbiome: Study of the bacterial flora of skin by swab method: Isolation of bacteria from skin on general purpose media (nutrient agar) and/or selective media (mannitol salt agar). Study of colony characteristics of the obtained isolates followed by Gram staining and microscopy to determine the gram character, shape and arrangement of cells.

##### **Unit 2: (14 hours)**

**Study of antibiotic sensitivity and rapid detection of infectious diseases:** Principle and performance of antibacterial sensitivity test by Kirby-Bauer method. Concept of MIC values. Determining MIC of any two antibiotics for any two bacteria.

Principles and working of rapid antigen tests. Demonstration of lateral flow kit for rapid antigen detection of COVID19. Principle and working of antibody detection test: Dengue test / Widal test for typhoid.

### **Essential/recommended readings**

#### ***Theory:***

1. Brock Biology of Microorganisms by M.T. Madigan, J. Aiyer, D. Buckley, W. Sattley and D. Stahl. 16th edition. Pearson, USA. 2021.
2. Prescott's Microbiology by J. M. Willey, K. Sandman and D. Wood. 11th edition. McGraw Hill Higher Education, USA. 2019.
3. Textbook of Microbiology by R. Ananthanarayan and C.K.J. Paniker. 10th edition. Universities Press, India. 2017.
4. Jawetz, Melnick and Adelberg's Medical Microbiology by K.C. Carroll, S.A. Morse, T.A. Mietzner and S. Miller. 27th edition. McGraw Hill Education. 2016.
5. Microbiology: An Introduction by G.J. Tortora, B.R. Funke and C.L. Case. 9th edition. Pearson Education, USA. 2007.
6. DNA microarrays for the diagnosis of infectious diseases by E. Donatin E and M. Drancourt. Med Mal Infect. 2012; 42(10):453-459. Doi:10.1016/j.medmal.2012.07.017

#### ***Practicals:***

1. A Handbook of Practical and Clinical Immunology Volumes I & 2 by G. P. Talwar and S.K. Gupta. 2nd edition. CBS Publishers, India. 2017.
2. Practical Immunology, A Laboratory Manual by S. Balakrishnan, K. Karthik and S. Duraisamy. Lambert Academic Publishing, India. 2017.
3. Microbiology: A Laboratory Manual by J. Cappuccino and C.T. Welsh. 11th edition. Pearson Education, USA. 2016.
4. Laboratory Manual on Immunology and Molecular Biology by D. Dwivedi and V. Singh. Lambert Academic Publishing, India. 2013.
5. Practical Immunology by F.C. Hay, M.R. Olwyn and M.R. Westwood. 4th edition. Wiley Blackwell Publishing. 2002.

### **Suggestive readings**

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.