

DISCIPLINE SPECIFIC CORE COURSE -7 (DSC-7) 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		
Medical Microbiology	4	3	-	1	----	NA

Learning objectives

The Learning Objectives of this course are as follows:

- The Medical Microbiology course has been formulated to impart basic and medically relevant information on microbes.
- The microbial structure, growth and development. Methods of isolation and characterization of microbes and role of sterilization in the context of study of microbes.
- 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.
- The course also deals with the problem of emerging antimicrobial resistance with reference to known pathogens.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Medical microbiology describes a broad perspective to study structure, classification, and diseases caused by microbes including bacteria, fungi, protozoa and viruses. The course helps to understand the nature of microorganism, their systematic classification and contribution of various scientists in the discovery of disease causing pathogen and its etiology. It also describes various culture media used for cultivation of microbes, their optimum physical, chemical and cultural requirements, techniques for purification and preservation of microbes.
- This course explains the various types of microbial cells, shape, size, molecular structure and their role in pathogenesis. The basic nutrient requirements of microorganism and how they behave in variable atmospheric conditions is also included. Analyzing optimum growth conditions that facilitate in growth and cultivation of useful microorganisms are also mentioned.
- Microbial genetics helps to understand the basic phenomenon of gene functioning and effects of various mutagens on microorganism, elucidates different methods of gene transfer and explains causes of genetic variation.
- Course also elucidates the interaction between host and their pathogens, mode of transmission of infectious diseases and their cure.
- This course also explains pathogenesis, etiology, clinical symptoms, control and cure of microbial diseases in addition to introducing antimicrobial action of antibiotics. Describes basic structural and morphological variation in various viruses, classification and their life cycle. Introduction to requirements of viruses for multiplication and detailed study of common disease causing viruses, virusoids and prions is also included.

SYLLABUS OF DSC-7

Unit I: Fundamental concepts

(10Hours)

- a) History of microbiology with special emphasis on contribution of Louis Pasteur and Robert Koch in Medical Microbiology.
- b) Major Divisions of life- Domains, Kingdoms; Requirements for microbial growth, growth factors, culture media- synthetic and complex, types of media. Techniques for obtaining pure cultures of microbes, preservation and storage of bacterial cultures, growth curve and generation time, control of microbial growth.

Unit II: Bacterial cell: fine structure and function

(10Hours)

Size, shape and arrangement of bacterial cells; Cell membrane, cytoplasmic matrix, inclusion bodies (e.g. Carboxysomes, magnetosomes, gas vacuoles, cyanophycean granules, PHB granules, glycogen granules), nucleoid, ultrastructure of gram positive and gram negative bacterial cell wall, sex pili, capsule, flagella & motility and endospore.

Unit III: Microbial genetics

(08Hours)

Mutants-auxotrophs and prototrophs, bacterial recombination: general and site specific and replicative, bacterial plasmids fertility factor, col plasmid, bacterial conjugation (Hfr, F', F⁺, F⁻), transformation, transduction- both generalized and specialized.

Unit IV: Host-pathogen relationship in the infectious diseases

(05Hours)

Relationship between normal microbiota and host, opportunistic microorganisms, nosocomial infections. Development and spread of infectious diseases: invasion, pathogen, parasite, pathogenicity, virulence, carriers and their types. Routes, mechanisms of invasion and establishment of infection.

Unit V: Microbial diseases

(06Hours)

Respiratory tract infections: with tuberculosis in detail, gastrointestinal tract infections, staphylococcal food poisoning. Life cycle of *Candida albicans* and *Plasmodium*.

Unit VI: Virus and virusoids

(06Hours)

General life cycle of a virus, structure, enveloped and un-enveloped viruses, plaque assay, growth curve, classification based on genetic material and detail study of influenza, SARS COV-2 and HIV virus with curative agent. Viroids, virusoids and prions.

Practical component

(30 Hours)

(Wherever wet lab experiments are not possible, the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Preparation of different media: synthetic media Davis-Mingioli media, complex media- nutrient agar or Luria agar media.
2. Isolation and purification of pure bacteria: streaking for single colonies
3. Propagation of pure bacteria in liquid culture
4. Gram's staining; gram positive and gram negative bacteria
5. Capsule staining of *Bacillus subtilis*/*Klebsiella*
6. Endospore staining of *Bacillus subtilis*
7. Study and plotting the growth curve of *E. coli* using turbidometric method
8. Isolation of bacteriophages from soil/sewer water and calculation of the plaque forming units (pfu)
9. To perform antibacterial testing by Kirby-Bauer method
10. Field visit to a clinical microbiology lab/diagnostic lab to familiarize with latest tools and

techniques used in microbial research

Essential readings:

- Dorothy Wood, Joanne Willey, Kathleen Sandman (2022). 12th Edition. Prescott's microbiology. New York, USA: McGraw-Hill Education. ISBN-10: 1-264-77733-7 / 1264777337
- Cappuccino, J.G. and Sherman, N. (2013). 10th Edition. Microbiology: A laboratory manual. California, USA: Benjamin Cumming. ISBN-13: 978-0321840226.

Suggestive readings for basics:

- Madigan, M.T., Martinko, J.M., Stahl, D.A. and Clark, D.P. (2010). 13th Edition. Brock biology of microorganisms. California, USA: Benjamin Cumming. ISBN-13: 978- 0321649638.
- Pelczar, M.J (2001). 5th Edition. Microbiology. New York, USA: McGraw Hill International. ISBN-13: 9780074623206.
- Tille, P. (2013). 13th Edition. Bailey & Scott's diagnostic microbiology. Missouri, USA: Mosby Publishers. ISBN-13: 978-0323083300.
- Tortora, G.J., Funke, B.R. and Case C.L. (2006). 9th Edition. Microbiology: An introduction. California, USA: Benjamin Cummings. ISBN-13: 978-0536292117.