GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)
Semester: 7
Subject Name: Medical Microbiology and Infectious Diseases
Subject Code: 1370406

Prerequisite: Students should have a fundamental understanding of microbiology, immunology, and molecular biology. Knowledge of pathogenic microorganisms, diagnostic techniques, and host-pathogen interactions is beneficial.

Rationale: This course provides in-depth knowledge of pathogenic bacteria, viruses, fungi, and parasites, focusing on infectious diseases, disease mechanisms, laboratory diagnostics, epidemiology, prevention, and treatment. It equips students with practical and theoretical expertise required for clinical microbiology, public health, and biopharmaceutical applications.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
4	0	8	8	70	30	30	20	150

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	**Unit 1: Introduction to Medical Microbiology** • History and scope of medical microbiology • Normal human microbiota and their role in health and disease • **Host-microbe interactions**: Commensalism, pathogenicity, and virulence factors • Concept of opportunistic infections and microbial dysbiosis • Laboratory biosafety levels (BSL-1 to BSL-4) and infection control measures	**12**	**20**
2	**Unit 2: Systemic and Clinical Infectious Diseases** • **Respiratory Tract Infections**: Tuberculosis, Pneumonia, COVID-19, Influenza • **Gastrointestinal Infections**: Cholera, Typhoid, Rotavirus, H. pylori • **Urinary Tract and Genital Infections**: E. coli, Gonorrhea, Syphilis, HPV	**12**	**20**

	• **Vector-Borne and Zoonotic Diseases**: Malaria, Dengue, Lyme disease, Leptospirosis • **Nosocomial and Biofilm-Associated Infections**: MRSA, Pseudomonas, Klebsiella		

3	**Unit 3: Diagnostic Microbiology and Laboratory Techniques**
	• **Specimen Collection, Transport, and Processing** (Blood, Urine, Sputum, CSF)
	• **Microscopy Techniques**: Gram Staining, Acid-Fast Staining, Fluorescent Microscopy
	• **Culture-Based Identification**: Aerobic & Anaerobic Culture, Selective & Differential Media
	• **Molecular and Immunological Diagnostics**:
	  ○ PCR, RT-PCR, qPCR, Next-Generation Sequencing (NGS)
	  ○ ELISA, Western Blot, Lateral Flow Assays (e.g., COVID-19, HIV tests)
	• **Automated and AI-Based Diagnostic Tools**
		12	**20**

4	**Unit 4: Antimicrobial Agents and Drug Resistance**
	• **Antimicrobial Therapy**: Antibiotics, Antivirals, Antifungals, Antiparasitics
	• **Mechanisms of Antimicrobial Action**
	• **Antibiotic Resistance Mechanisms and Superbugs** (MRSA, XDR-TB, NDM-1)
	• **Emerging Solutions to Drug Resistance**:
	  ○ Phage Therapy
	  ○ CRISPR-Based Antimicrobials
	  ○ AI-Driven Drug Discovery
	• **Role of WHO, ICMR, and CDC in AMR Management**
		12	**20**

5	**Unit 5: Emerging Infectious Diseases and Public Health Microbiology** • **Emerging & Re-Emerging Diseases**: Ebola, Zika, Nipah, Bird Flu, COVID-19 • **Vaccines and Immunoprophylaxis**: Live, Attenuated, mRNA, DNA Vaccines • **Bioterrorism and Biological Weapons**: Anthrax, Smallpox, Ricin	**12**	**20**

	• **Role of Public Health Organizations in Disease Control**: WHO, CDC, ICMR • **One Health Approach in Global Disease Surveillance**		

Reference Books:

1. Medical Microbiology – Patrick R. Murray, Ken S. Rosenthal
2. Jawetz, Melnick & Adelberg's Medical Microbiology – Geo F. Brooks
3. Sherris Medical Microbiology – Kenneth J. Ryan, C. George Ray
4. Diagnostic Microbiology – Connie R. Mahon
5. Clinical Microbiology Procedures Handbook – Henry D. Isenberg

Course Outcome:

After Completion of the Course, Student will able to:

Sr. No	Course Outcomes	RBT Level
1	Medical Microbiology and Infectious Diseases study microorganisms like bacteria, viruses, fungi, and parasites that cause human diseases.	UN, RM, AP
2	This field is essential for diagnosing infections, understanding disease mechanisms, and developing effective treatments.	UN, RM, AP
3	It plays a crucial role in public health by aiding in the prevention and control of infectious disease outbreaks.	AP, AN, CR
4	Research in medical microbiology contributes to advancements in vaccines, antibiotics, and antimicrobial resistance management.	AN, EL, CR
5	With emerging global health threats, continuous study in this area is vital for improving healthcare and disease prevention strategies.	AP, CR

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Experiments:

1. Microscopic Identification: Gram staining, Acid-fast staining, Fluorescent staining
2. Bacterial Culture & Colony Characterization and study of virulence factors
3. Antibiotic Susceptibility Testing (AST) – Kirby-Bauer Method/MIC/ Automation
4. PCR-Based Detection of Pathogens (COVID-19, Tuberculosis, H1N1)
5. ELISA for Infectious Disease Diagnosis (HIV, Dengue, Hepatitis B)
6. Blood Culture of Pathogenic Bacteria
7. Environmental and Hospital Surface Microbiological Sampling
8. Fungal Identification using Lactophenol Cotton Blue Staining

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