

UNIVERSITY OF KALYANI



SYLLABUS FOR MICROBIOLOGY (MULTI DISCIPLINARY COURSE)

UNDER
CURRICULUM AND CREDIT FRAMEWORK
FOR
UNDERGRADUATE PROGRAM
(WITH EFFECT FROM THE SESSION 2023-24)

Course-wise Content of the Syllabus
University of Kalyani
UG Multi-Disciplinary Course in Microbiology

SEMESTER-I	
COURSE CODE	MB-MU-T-01
COURSE TITLE	FUNDAMENTALS AND TECHNIQUES IN MICROBIOLOGY (THEORY)
CREDIT	3
FULL MARKS	45
CONTENT	Unit 1: Introduction, History and Scope of Microbiology- General concept of microbes, their distribution and dimension. History and Scope of microbiology as a modern science. Branches of Microbiology. Contribution of Scientists to the field of Microbiology - Antony Von Leuwenhoek, Edward Jenner, Lazaro Spallanzani, Louis Pasteur, Joseph Lister, Robert Koch, Alexander Fleming and Iwanovsky. Theories of origin of life. Unit 2: Microbial growth requirements and culture techniques- Nutritional requirements of microorganisms -Macronutrients, micronutrients and growth factors. Physical factors affecting growth of microorganisms: Temperature, pH and Oxygen. Culture media: Components of media, Synthetic or defined media, Complex media, enriched media, selective media, differential media, enrichment culture media. Pure culture isolation: Streaking, serial dilution and plating methods, cultivation, maintenance and stocking of pure cultures. Growth: concept of growth of microorganisms; measurement of growth; Different phases of bacterial growth, specific growth rate, growth curve. Counting of bacteria - Viable count, Total count and turbidimetric estimation. Unit 3: Stains and Staining Techniques- Nature of dyes. Physical and chemical theories of staining- Staining techniques; principle, procedure and applications of i) Simple staining- negative staining, ii) Differential staining - Grams and acid fast staining, iii) Structural staining- cell wall, endospore, flagella and capsular staining. Unit 4: Sterilization and aseptic Techniques- Definition of terms -sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agents and antimicrobial agent. Evaluation of antimicrobial chemical agents- Tube dilution and agar plate techniques- well method and disk plate method. Physical methods of control- Principle, construction and application of moist heat sterilization- Boiling, Pasteurization, Fractional sterilization- Tyndallization and Moist heat under pressure- autoclave. Dry heat sterilization- Incineration and hot air oven, Filtration -membrane filter and laminar air flows, Radiation -Ionizing radiation– γ rays and non-ionizing radiation- UV-rays. Chemical methods: Alcohol, aldehydes, phenols, halogen, metallic salts, quaternary ammonium compounds and sterilizing gases as antimicrobial agents. Selection of a chemical agent for practical applications.

SEMESTER II	
COURSE CODE	MB-MU-T-02
COURSE TITLE	MICROBIAL SYSTEMATICS AND DIVERSITY (THEORY)
CREDIT	3
FULL MARKS	45
CONTENT	Unit 1: Microbial Systematics- General account of systematics, classification and nomenclature; Classification systems- artificial or phonetic, natural and phylogenetic; Species concept in microbiology, monophyletic, paraphyletic, polyphyletic; Newer approaches for exploring unculturable bacteria-molecular taxonomy, molecular phylogeny, molecular chronometers; Chemotaxonomy; Polyphasic taxonomy, Unit 2: Phylogeny of prokaryons- Diversity of more complex unicellular complex microorganisms: Monera (Prokaryote), Protista. Five kingdom domains in Whittaker's system of classification and Archaea, Bacteria and Eukarya, RNA world. Theory of endosymbiogenesis. Unit 3: An account of prokaryons- Brief accounts of major subgroups of these classes. The thermophilic, methanogenic and halophilic Archaea; photosynthetic bacteria, Cyanobacteria, Gram positive and Gram negative Eubacteria; including the five classes of Proteobacteria, Spirochetes and Actinomycetes. Unit 4: Phycology- General characteristics of algae including occurrence, thallus organization, algal cell ultrastructure, pigments, flagella, eye spot, food reserves and vegetative, asexual and sexual reproduction, General characters of the following classes: Chlorophyta, Xanthophyta, Cyanophyta. Applications of algae in agriculture, industry, environment and food. Unit 5: An account of eukaryotic microbes- Fungi including Zygomycetes, Oomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes (imperfect and perfect stages) and Protozoa (<i>Giardia</i>, <i>Entamoeba</i> and <i>Plasmodium</i>). Unit 6: General Account of Virology- Discovery of viruses, distinctive property of viruses; morphology and ultrastructure, capsids & their arrangements. Types of envelopes and their composition; viral genome – types and structures; nomenclature and classification of virus (Animal, plant, bacterial viruses). Virus related agents – virioids, prions. Structural organization of bacteriophage; Life cycle – lytic & lysogenic,
SEMESTER III	
COURSE CODE	MB-MU-T-03
COURSE TITLE	PUBLIC HEALTH AND MEDICAL MICROBIOLOGY (THEORY)

CREDIT	3
FULL MARKS	45
COURSE OUTCOME	- Students will know about beneficial and disease-causing microbes - They will have an overview on public health, community health and clinical health system and the terminologies used in these practices (Epidemiology, pandemic, epidemic, endemic etc) - Students will be able to correlate disease symptoms with causative agent, isolate and identify pathogens. - They will gain knowledge of mechanism of action of antimicrobial drugs and prophylaxis. - Students will learn hands-on to identify bacteria by simple testing and qualitative and quantitative method to understand the working of antimicrobials
CONTENT	Unit 1: Epidemic, Endemic, Pandemic. Herd immunity. virulence, virulence factors- exotoxins, endotoxins, neurotoxins and enzymes with special reference to Cholera toxin, enterotoxin, diphtheria toxin and tetanospasmin, Definition and differences-Public health, Clinical health, Iceberg phenomenon Unit 2: Bacterial diseases- Symptoms, mode of transmission, and treatment Respiratory Diseases: tuberculosis; Gastrointestinal Diseases: typhoid, cholera; Wound infections: tetanus; Venereal disease: Syphilis Unit 3: Viral diseases- Symptoms, mode of transmission, prophylaxis and control of following diseases: SARS-CoV-2, AIDS, Dengue Unit 4: Protozoan diseases- Symptoms, mode of transmission, prophylaxis and control of following diseases: Malaria, Unit 5: Fungal diseases- General account on transmission, symptoms and prevention of candidiasis Unit 3: Human and microbes interactions: Normal microbial flora of the human body. Probiotic, prebiotic Unit 4: Antimicrobial agents: Antibiotics produced by bacteria, actinomycetes and fungi used in chemotherapy. Classification of antibiotics on the basis of structure and mode of action. Assay of antibiotics, antibiotic spectrum Semisynthetic antibiotic. Nalidixic acid, nitrofurans, isonicotinic hydrazide, metronidazole; Prophylactic agents. Drug toxicity. Drug resistance

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