General Microbiology

Description of the Course

Course Title: General Microbiology
Course No: MB 101 (Major)
Nature of the Course: Theory

Full Marks: 100
Pass Marks: 35
Year: I
Total Lecture Hours: 150

Course Objectives

After completion of the course, the students will be able to:

a) understand the concept of microorganisms, history of microbiology, classification schemes and the nomenclature of microorganisms, scope and applications of microbiology
b) know handling methods, growth, physiology, metabolism, genetics of microorganisms
c) understand basics of bacteriology, virology, mycology and parasitology

Course Contents

History and development of microbiology **4hrs**

Development of microbiology with reference to modern era, important discoveries, theories of spontaneous generation and germ theory of disease (Louis Pasteur, Robert Koch)

Classification and nomenclature of microorganisms **15hrs**

Classification schemes of living organism, differential characteristics of prokaryotic and eukaryotic microorganism. General principle of nomenclature, three and five kingdom concepts, basic understanding of classification of bacteria, viruses, fungi and protozoa, classification, nomenclature and characterization of bacteria according to Bergey's Manual of Systematic Bacteriology

Scope and applications of microbiology **7hrs**

Harmful and beneficial microorganism; applied microbiology (medical, public health, agricultural, food, microbial biotechnology, environmental, industrial, pharmaceutical microbiology)

Morphology of bacteria **10hrs**

Structure of bacteria, morphology and fine structure of cell organelles, differences between gram negative and gram positive bacteria

Growth and physiology of bacteria **8hrs**

Nutritional types of bacteria (photolithotrophic, chemolithotrophic, photoorganotrophic, chemoorganotrophic), entry of nutrients, passive and active transport, bacterial growth, growth curve, factors affecting growth

Isolation, enumeration and culture of bacteria **10hrs**

Types of bacteriological culture medium, techniques for isolation and enumeration of bacteria (streak plate technique, pour plate technique, spread plate technique, membrane filtration, most probable number method, direct microscopic count), biochemical tests of bacteria, methods of culture of aerobic and anaerobic bacteria, culture preservation methods

Metabolism **15hrs**

Introduction to metabolism, regulation and energy involvement in glycolysis (Embden Mayerhoff Paranas pathway), glycogenesis, glycogenolysis, TCA cycle, pentose phosphate pathway, Entner Doudoroff's pathway, phosphoketolase pathway, fermentative pathways and electron transport system

Microbial genetics **15hrs**

Structure and function of prokaryotic DNA, genetic code, plasmids, concepts of bacterial genetics and role of RNA & DNA; bacterial recombination (transformation, conjugation and transduction), types and importance of mutation

Microscopy and different techniques of handling of microorganisms **8hrs**

Microscopes (light, stereo, dark field, phase contrast, electron, fluorescence), types of staining and nature of dyes/stains, different types of staining methods for microorganisms, aseptic techniques in microbiology

Techniques in control of microorganisms **12hrs**

Principles, procedures and applications of disinfection and sterilization-temperature, irradiation, ultrasonication, filtration, chemicals, antibiotics and chemotherapeutic agents

Host parasite interaction **10hrs**

Normal microbial flora of human body, concept of host parasite relationship, concept of immunity

Introduction to virology **12hrs**

General structure (size, symmetry and shape) of virus, classification schemes, viral genetics, detection, enumeration (plaque assay, haemagglutination test, quantitative PCR, neutralization test), cultivation of viruses

Introduction to parasitology **12hrs**

Origin, morphology and classification of parasites (blood, tissue, intestinal parasites, soil transmitted helminths and nematodes), techniques of detection, enumeration and identification of protozoan and helminthic parasites

Introduction to mycology **12hrs**

Origin, morphology and medical classification of fungi. Techniques of isolation, morphological identification, culture and enumeration of yeast and mold

Recommended Readings

Text books

1. Collins CH, Patricia M, and Lyne JM (1995). Collins and Lynes Microbiological Methods 7th edition. Grange, Butter Worth, Oxford.
2. Cappucino JG and Sherman N (1996). Microbiology, A Laboratory Manual 4th edition. Benjamin Cumings Inc. California.
3. Pelczar MJ, Chan ECS and Krieg NR (1993). Microbiology 5th edition, Tata McGraw Hill.
4. Madigan MT, Martinko JM and Parker J (2012). Brock Biology of Microorganism, 11th edition Prentice Hall International Inc. London.

Reference books

1. Atlas RN (1984). Microbiology: Fundamental and Applications. Memillan Co.
2. Greenwood D, Richard CD, John S and Peuther F (1992). Medical Microbiology, 16th edition. ELBS, Churchill living stone.

General Microbiology Practical

Description of the Course

Course Title: General Microbiology Practical
Course No: MB 102 (Major)
Nature of the Course: Practical

Full Marks: 50
Pass Marks: 20
Year: I
Total Lecture Hours: 180

Course Objective

After completion of the course, the students will be able to:

a) develop practical skills on basic microbiological procedures for handling, culture, isolation and identification of microorganisms.

Course Contents

To operate and learn working principle of: Microscope.
To operate and learn working principle of: Hot air oven, autoclave, incubator, UV safety hood and spectrophotometer.
To perform staining of bacteria: Simple staining, gram's staining, negative staining, flagella staining, spore staining and capsule staining, Ziehl Neelson staining
To perform the biochemical tests of bacteria: Catalase test, oxidase test, urease test, sugar fermentation, indole test, MR tests, VP test, citrate test, TSI test, nitrate reduction test, starch hydrolysis, lipid hydrolysis, protein hydrolysis
To prepare microbiological culture media: Nutrient agar, MacConkey agar, blood agar, potato dextrose agar, broth media
To perform isolation and enumeration of bacteria by Streak plate technique, spread plate technique, pour plate technique, MPN and MF method
To determine the size of bacteria by Micrometry technique
To determine the motility of bacteria Hanging drop method
To measure the bacterial growth and calculate the generation time
To study effect of temperature, pH, salt concentration, sugar concentration on microbial growth
To perform yeast and mold count and morphological identification of fungi
To perform culture of anaerobic bacteria
To perform antibiotic susceptibility test by Kirby Bauer disc diffusion method