Course Code	Course Name	L-T-P-Credits	Year of Introduction
BT207	Microbiology	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To give a fundamental understanding of microbe based bioprocess system.
- Tol equip the students in applying their knowledge of microorganisms to a variety of bioprocess situations, in all realms of human endeavor.

Syllabus

Historical aspects and the landmark discoveries of microbiology; microscopy and staining techniques. Eukaryotic and prokaryotic cell structure and function; microbial taxonomy; classification systems, Microbial nutrition and cultivation, Microbial growth and control of microorganisms. Microbial interactions and ecology; microorganisms in different environments- aquatic and soil. Application of microbiology.

Expected outcome

Upon successful completion of this course, the students will be able to

- Identify and characterize the major groups of microorganisms.
- Understand basic techniques for visualization, cultivation and identification of a variety of microorganisms.
- Distinguish among viral, prokaryotic and eukaryotic structure, organization, metabolism and environmental needs.
- Relate the role of microbial interactions with ecology and applications.

Reference Books

1. Prescott, Harley and Klein, *Microbiology*, McGraw Hill International Edition, 2008.
2. Pelczar M. J., E. C. E. Chan and N. R. Krieg, *Microbiology*, Tata McGraw Hill, 1993.
3. Ingraham J. L. and C. A. lngraham, *Introduction to Micro Biology A Case History Approach*, 3/e, Thomson Publications, 2003.
4. Brock, *Biology of Microorganism*, Prentice Hall, International Inc, 2005.
5. Schlegel H. G., *General Microbiology*, Cambridge University Press, 1993.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**Historical perspectives:** Discovery of microbial world; Landmark discoveries relevant to the field of microbiology; controversy over spontaneous generation-Scope and relevance of microbiology. Role of microorganisms in transformation biotransformation. **Microscopic techniques:** light microscopy, dark field microscopy, phase contrast microscopy, fluorescence microscopy, SEM, TEM, newer techniques: confocal microscopy, scanning probe microscopy. **Staining techniques:** cell staining- simple staining, gram staining and acid fast staining; staining of specific structures.	7	15%

II	**Study of microbial structure** **Eukaryotic and prokaryotic cell structure and function:** size, shape and arrangement, cell membranes, cell organelles, cell walls, component external to cell walls. Microbial chemotaxis, mechanisms of solute transport across cell membranes. **Microbial taxonomy**: Evolution and diversity of microorganisms, taxonomic ranks, classification systems, assessment of microbial phylogeny. Bacteria, archaea and their broad classification; Eukaryotic microbes: Yeasts, molds and protozoa; viruses and their classification, viroids and prions.	7	15%
FIRST INTERNAL EXAM			
III	**Microbial nutrition and cultivation**: Nutrition of microorganisms; nutritional classes of microbes, Macro and micronutrients, sources and physiological functions of nutrients. Growth factors and their functions in metabolism. **Cultivation of microorganisms**: Culture media- synthetic, complex media, solidifying agents, types of media - selective, differential and enrichment media, pure culture methods - spread plate, pour plate and streak plate, special techniques for cultivation of anaerobes.	7	15%
IV	**Microbial Growth**: Definition of growth; growth curve; mathematical expression of exponential growth phase; measurement of growth and growth yields; synchronous growth; effect of environmental factors on growth, growth in natural environments. **Control of microorganisms**: Basic terminology- sterilization, disinfection, sanitization, antisepsis. Patterns of microbial death, physical methods for microbial control- heat, low temperature, filtration and radiation. Use of chemical agents, evaluation of effectiveness of antimicrobial agents.	8	15%
SECOND INTERNAL EXAM			
V	**Microbial interactions and ecology**: Types of microbial interactions - mutualism, protocooperation, commensalisms, predation, parasitism, amensalism, competition, symbiosis. Biogeochemical cycles: cycles of nitrogen, carbon, sulphur and manganese. **Microorganisms in aquatic environments**: microbial community in marine and fresh water environments, microbiological analysis of water purity-sanitary tests for coliforms (presumptive test, confirmed test, competed test), MPN test, defined substrate test, IMVIC test. Quality standards for drinking water. **Soil microbiology**: Soil as a habitat for microorganisms, physico-chemical properties of soil, microbial community in soil, role of microorganisms in organic matter decomposition.	8	20%
VI	**Application of microbiology**: Food microbiology- Role of microorganisms in food spoilage and contamination, food preservation methods - physical and chemical methods, food	5	20%

	borne diseases and intoxications, examples of fermented food products. Industrial microbiology- Microorganisms as biofertilizers and biopesticides, commercially important microorganisms for industrial fermentation.		
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 hours

The question paper consists of Part A, Part B and Part C.

Part A consists of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer two questions (15×2=30 marks).

Part B consists of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer two questions (15×2=30 marks).

Part C consists of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer two questions (20×2=40 marks).

Note : Each question can have a maximum of 4 subparts, if needed.