TECHNO INDIA UNIVERSITY
WESTBENGAL

Syllabus for 3-year B.Sc (Honours)in Microbiology

2018

Choice Based Credit System (CBCS)

Department of Microbiology

Techno India University, West Bengal

EM-4, EM Block, Sector V, Bidhannagar, Kolkata, West Bengal 700091

TECHNO INDIA UNIVERSITY
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B.Sc Microbiology (CBCS)

Course Curriculum for All Semester

Semester I

Sl. No.	Course Code	Course Title	Contact Hrs. / Week			Credit	Page No.
			L	T	P		
Theory							
1	TIU-HMB-T101	Introduction to Microbiology and Microbial Diversity	03	01	00	04	
2	TIU-HMB-T103	Bacteriology	03	01	00	04	
3	TIU-GCH-E101	Chemistry	03	01	00	04	
4	TIU-AEC-T105	English	02	00	00	02	
Practical							
1	TIU-HMB-L101	Introduction to Microbiology and Microbial Diversity	00	00	02	02	
2	TIU-HMB-L103	Bacteriology	00	00	02	02	
3	TIU-GCH-L101	Chemistry	00	00	02	02	
Total Credit						20	

CORE COURSES

SEMESTER –1

TIU-HMB-T101: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Course Outcome:

After successful completion, this course enables students:

- To gain knowledge about the basics of microbiology and to learn the systemic classification of microorganisms.
- To understand the general characteristics of acellular microorganisms.
- To understand the general characteristics, life-cycle and application of algae.
- To understand the general characteristics, life-cycle and application of fungi.
- To understand the general characteristics, life-cycle and application of protozoan.

Contents:

Unit 1: History of Development of Microbiology No. of Hours: 15

Development of microbiology as a discipline, Spontaneous generation vs. biogenesis. Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming Role of microorganisms in fermentation, Germ theory of disease, Development of various microbiological techniques and golden era of microbiology, Development of the field of soil microbiology: Contributions of Martinus W. Beijerinck, Sergei N. Winogradsky, Selman A.Waksman Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich, Elie Metchnikoff, Edward Jenner

Unit 2 Diversity of Microbial World No. of Hours: 40

A. Classification Systems

Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms

B. General characteristics of different groups:

Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance.

• Algae

History of phycology with emphasis on contributions of Indian scientists; General characteristics of algae including occurrence, thallus organization, algae cell ultra-structure, pigments, flagella, eyespot food reserves and vegetative, asexual and sexual reproduction. Different types of life cycles in algae with suitable examples: Haplobiontic, Haplontic, Diplontic, Diplobiontic and Diplohaplontic life cycles. Applications of algae in agriculture, industry, environment and food.

• Fungi

Historical developments in the field of Mycology including significant contributions of eminent mycologists. General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism. Economic importance of fungi with examples in agriculture, environment, Industry, medicine, food, biodeterioration and mycotoxins.

• Protozoa

General characteristics with special reference to Amoeba, Paramecium, Plasmodium, Leishmania and Giardia

Unit 3 An overview of Scope of Microbiology No. of Hours: 5

TIU-HMB-L101:INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY (PRACTICALS)

TOTAL HOURS: 60CREDITS: 2

1. Microbiology Good Laboratory Practices and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory.
3. Preparation of culture media for bacterial cultivation.
4. Sterilization of medium using Autoclave and assessment for sterility
5. Sterilization of glassware using Hot Air Oven and assessment for sterility
6. Sterilization of heat sensitive material by membrane filtration and assessment for sterility
7. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
8. Study of Rhizopus, Penicillium, Aspergillus using temporary mounts
9. Study of Spirogyra and Chlamydomonas, Volvox using temporary Mounts
10. Study of the following protozoans using permanentmounts/photographs: Amoeba, Entamoeba,Paramecium and Plasmodium

SUGGESTED READING

1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education

2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition. Pearson International Edition

3. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited

4.Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology.9th Edition.McGraw Hill International.

5. Atlas RM. (1997).Principles of Microbiology.2nd edition.WM.T.Brown Publishers.

6. Pelczar MJ, Chan ECS and Krieg NR.(1993). Microbiology.5th edition. McGraw Hill Book Company.

7. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.

TIU-HMB-T103: BACTERIOLOGY (THEORY)

TOTAL HOURS: 60CREDITS: 4

Course Outcome:

After successful completion, this course enables students:

- To understand detailed structure of Gram-positive and Gram-negative bacteria.
- Be able to know about cultivation, maintenance and preservation/stocking of pure cultures.
- To understand about Growth, nutrition and reproduction in bacteria.
- To understand the Bacterial systematics aim and principles of classification, systematics and taxonomy, concept of species
- To understand general characteristics, phylogenetic overview of important archaeal and eubacterial groups.

Contents:

Unit 1 Cell organizationNo. of Hours: 14

Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae and pili.Cellwall: Composition and detailed structure of Gram-positive and Gram-negative cell walls, Archaebacterial cell wall, Gram and acid fast staining mechanisms, lipopolysaccharide (LPS), sphaeroplasts, protoplasts, and L-forms. Effect of antibiotics and enzymes on the cell wall.

Cell Membrane: Structure, function and chemical composition of bacterial and archaeal cell membranes. Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids Endospore: Structure, formation, stages of sporulation.

Unit 2 Bacteriological techniquesNo. of Hours: 5

Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing nonculturable bacteria.

Unit 3 Microscopy No. of Hours: 6Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluoresence Microscope, Confocal microscopy, Scanning and Transmission Electron Microscope

Unit 4 Growth and nutrition No. of Hours: 8 Nutritional requirements in bacteria and nutritional categories;

Culture media: components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media

Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation

Chemical methods of microbial control: disinfectants, types and mode of action Unit 5 Reproduction in Bacteria No. of Hours: 3

Asexual methods of reproduction, logarithmic representation of bacterial populations, phases of growth, calculation of generation time and specific growth rate

Unit 6 Bacterial Systematics No. of Hours: 8

Aim and principles of classification, systematics and taxonomy, concept of species, taxa, strain; conventional, molecular and recent approaches to polyphasic bacterial taxonomy, evolutionary chronometers, rRNA oligonucleotide sequencing, signature sequences, and protein sequences. Differences between eubacteria and archaebacteria

Unit 7 Important archaeal and eubacterial groups No. of Hours: 16

Archaebacteria: General characteristics, phylogenetic overview, genera belonging to Nanoarchaeota (Nanoarchaeum), Crenarchaeota (Sulfolobus, Thermoproteus) and Euryarchaeota [Methanogens (Methanobacterium, Methanocaldococcus), thermophiles (Thermococcus, Pyrococcus, Thermoplasma), and Halophiles (Halobacterium, Halococcus)]

Eubacteria: Morphology, metabolism, ecological significance and economic importance of following groups:

Gram Negative: Non proteobacteria: General characteristics with suitable examples Alpha proteobacteria: General characteristics with suitable examples Beta proteobacteria: General characteristics with suitable examples Gamma proteobacteria: General characteristics with suitable examples Delta proteobacteria: General characteristics with suitable examples Epsilon proteobacteria: General characteristics with suitable examples Zeta proteobacteria: General characteristics with suitable examples Gram Positive:

Low G+ C (Firmicutes): General characteristics with suitable examples High G+C (Actinobacteria): General characteristics with suitable examples

Cyanobacteria: An Introduction

TIU-HMB-L103:BACTERIOLOGY (PRACTICALS)

TOTAL HOURS: 60 CREDITS: 2

1. Preparation of different media: synthetic media BG-11, Complex media-Nutrient agar, McConkey agar, EMB agar.

2. Simple staining

3. Negative staining

4. Gram's staining

5. Acid fast staining-permanent slide only.

6. Capsule staining

7. Endospore staining.

8. Isolation of pure cultures of bacteria by streaking method.

9. Preservation of bacterial cultures by various techniques.

10. Estimation of CFU count by spread plate method/pour plate method.

11. Motility by hanging drop method.

SUGGESTED READINGS

1. Atlas RM. (1997).Principles of Microbiology.2nd edition.WM.T.Brown Publishers.

2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall

3. Madigan MT, and Martinko JM.(2014). Brock Biology of Micro-organisms.14th edition.Parker J. Prentice Hall International, Inc.

4. PelczarJr MJ, Chan ECS, and Krieg NR.(2004). Microbiology.5th edition Tata McGraw Hill.

5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht

6. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.

7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.

8. Willey JM, Sherwood LM, and Woolverton CJ.(2013). Prescott's Microbiology.9th edition.McGraw Hill Higher Education.

9. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited