



**TECHNO INDIA UNIVERSITY**  
WESTBENGAL

**3yr B.Sc (HONOURS)**

**In**

**MICROBIOLOGY**

**SYLLABUS**

**Choice Based Credit System (CBCS)**

**2019**



Semester Wise Microbiology Honours Courses						
	1	2	3	4	5	6
<b>Core Courses</b>	TIU-HMB-T1C1 TIU-HMB-P1C1 TIU-HMB-T1C3 TIU-HMB-P1C3 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T1C2 TIU-HMB-P1C2 TIU-HMB-T1C4 TIU-HMB-P1C4 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T2C5 TIU-HMB-P2C5 TIU-HMB-T2C7 TIU-HMB-P2C7 TIU-HMB-T2C9 TIU-HMB-P2C9 3T+3P (3X4+3X2=18 Credits)	TIU-HMB-T2C6 TIU-HMB-P2C6 TIU-HMB-T2C8 TIU-HMB-P2C8 TIU-HMB-T2C10 TIU-HMB-P2C10 3T+3P (3X4+3X2=18 Credits)	TIU-HMB-T3C11 TIU-HMB-P3C11 TIU-HMB-T3C13 TIU-HMB-P3C13 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T3C12 TIU-HMB-P3C12 TIU-HMB-T3C14 TIU-HMB-P3C14 2T+2P (2X4+2X2=12 Credits)
<b>Generic Elective Courses</b>	TIU-UCH-T1G1 TIU-UCH-P1G1 1T+1P (1X4+1X2=6 Credits)	TIU-UCH-T1G2 TIU-UCH-P1G2 1T+1P(1X4+1X2=6 Credits)	TIU-UCS-T2G1 TIU-UCS-P2G1 1T+1P (1X4+1X2=6 Credits)	TIU-UCS-T2G2 TIU-UCS-P2G2 1T+1P (1X4+1X2=6 Credits)		
<b>Discipline Specific Elective Courses</b>					TIU-HMB-T3D1 TIU-HMB-P3D1 TIU-HMB-T3D3 TIU-HMB-P3D3 TIU-HMB-T3D5 TIU-HMB-P3D5 2T+2P Any two: (2X4+2X2=12 Credits)	TIU-HMB-T3D2 TIU-HMB-P3D2 TIU-HMB-T3D4 TIU-HMB-P3D4 TIU-HMB-T3D6 TIU-HMB-P3D6 2T+2P Any two: (2X4+2X2=12 Credits)
<b>Skill Enhancement Elective Courses</b>			TIU-HMB-T2S1 TIU-HMB-P2S1 TIU-HMB-T2S3 TIU-HMB-P2S3 1T+0P (1X2=2 Credits)Any one	TIU-HMB-T2S2 TIU-HMB-P2S2 TIU-HMB-T2S4 TIU-HMB-P2S4 1T+0P(1X2=2 Credits)Any one		
<b>CASD</b>	TIU-UCE-T105 1T+0P (2 Credits) (language)	TIU-UES-T106 1T+0P (2 Credits) (Environmental Science)				
<b>Total = 140 Credits</b>	20 Credits	20 Credits	26 Credits	26 Credits	24 Credits	24 Credits





Core Courses		
Semester	Core Courses (Code)	Subject
1	TIU-HMB-T1C1 TIU-HMB-P1C1	Introduction to microbiology and microbial diversity
	TIU-HMB-T1C3 TIU-HMB-P1C3	Bacteriology
2	TIU-HMB-T1C2 TIU-HMB-P1C2	Biochemistry
	TIU-HMB-T1C4 TIU-HMB-P1C4	Cell Biology
3	TIU-HMB-T2C5 TIU-HMB-P2C5	Virology
	TIU-HMB-T2C7 TIU-HMB-P2C7	Microbial physiology and metabolism
	TIU-HMB-T2C9 TIU-HMB-P2C9	Molecular Biology
4	TIU-HMB-T2C6 TIU-HMB-P2C6	Microbial Genetics
	TIU-HMB-T2C8 TIU-HMB-P2C8	Environmental Microbiology
	TIU-HMB-T2C10 TIU-HMB-P2C10	Recombinant DNA Technology
5	TIU-HMB-T3C11 TIU-HMB-P3C11	Food and Dairy Microbiology
	TIU-HMB-T3C13 TIU-HMB-P3C13	Industrial Microbiology
6	TIU-HMB-T3C12 TIU-HMB-P3C13	Immunology
	TIU-HMB-T3C14 TIU-HMB-P3C14	Medical Microbiology





<b>Skill Enhancement Elective Courses</b>		
<b>Semester</b>	<b>Core Courses (Code)</b>	<b>Subject</b>
<b>3</b>	TIU-HMB-T2S1 TIU-HMB-P2S1	Bio fertilizer
	TIU-HMB-T2S3 TIU-HMB-P2S3	Microbial quality control in food and pharmaceutical industry
<b>4</b>	TIU-HMB-T2S2 TIU-HMB-P2S2	Food Fermentation Technique
	TIU-HMB-T2S4 TIU-HMB-P2S4	Microbiological analysis of air and water

<b>Discipline Specific Elective Courses</b>		
<b>Semester</b>	<b>Core Courses (Code)</b>	<b>Subject</b>
<b>5</b>	TIU-HMB-T3D1 TIU-HMB-P3D1	Biostatistics
	TIU-HMB-T3D3 TIU-HMB-P3D3	Medical & Diagnostics Microbiology
	TIU-HMB-T3D5 TIU-HMB-P3D5	Advance Method in Microbiology
<b>6</b>	TIU-HMB-T3D2 TIU-HMB-P3D2	Inheritance Biology
	TIU-HMB-T3D4 TIU-HMB-P3D4	Bioinformatics
	TIU-HMB-T3D6 TIU-HMB-P3D6	Project Work





## CORE COURSES

### SEMESTER –1

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

<b>TOTAL</b>	<b>HOURS:</b>	<b>60</b>
		<b>CREDITS</b>
<b>: 4</b>		

#### **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. Systems of classification**

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: 60 CREDITS: 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 permanent mounts/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. W.M.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: 60 CREDITS: 4**

#### **Unit 1 Cell organization No. of Hours: 14**

Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae and pili. Cell wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls, Archaeobacterial 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 techniques No. 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: 6** Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence 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 archaeobacteria

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

**Archaeobacteria:** 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. W.M.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

