TECHNO INDIA UNIVERSITY
WESTBENGAL

# Proposed Syllabus for 4-year B.Sc (Honours with or without research) (NEP)

## 2023

# MICROBIOLOGY

## Department of Microbiology



**Techno India University, West Bengal**
**EM-4, EM Block, Sector V, Bidhannagar,**
**Kolkata, West Bengal 700091**

TECHNO INDIA UNIVERSITY
WESTBENGAL

| B.Sc Microbiology<br>COURSE STRUCTURE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Degree** | **Semester** | **Core** | **Minor** | **MDC** | **AEC** | **SEC** | **CVAC** | **Summer Internship** | **DSC** | **Dissertation/ Research work** | **Total Credit** |
| **Certificate in Microbiology** | I | 4 (1X 4) | 4 | 3 | 2 | 3 | 2 (1 x 2) | | | | 18 |
| | II | 4 (1 X 4) | 4 | 3 | 2 | 3 | 4 (2 x 2) | | | | 20 |
| **Diploma in Microbiology** | III | 8 (2 X 4) | 4 | 3 | 2 | 3 | | | | | 20 |
| | IV | 16 (4 X 4) | 4 | | 2 | | | | | | 22 |
| **B.Sc (Three Years) in Microbiology** | V | 12 (3 X 4) | 8 | | | | | | | | 20 |
| | VI | 12 (3 X 4) | 8 | | | | | 4 | | | 24 |
| **B.Sc (Hons.) in Microbiology (with research)** | VII | 12 (3 X 4) | | | | | | | | 4 | 16 |
| | VIII | 12 (3 X 4) | | | | | | | | 8 (4 x 2) | 20 |
| **B.Sc (Hons.) in Microbi** | VII | 20 (5 X 4) | | | | | | | | | 20 |

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| **ology (without researc h)** | VIII | 20 (5 X 4) | | | | | | | | | 20 |

| **Credit Requirements for obtained different degree** | | |
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| **Degree** | **Year** | **Total Credit** |
| **Certificate in Microbiology** | **1** | 38 |
| **Diploma in Microbiology** | **2** | 80 |
| **B.Sc (Three Years) in Microbiology** | **3** | 120 |
| **B.Sc (Hons.) in Microbiology (with research)** | **4** | 160 |
| **B.Sc (Hons.) in Microbiology (without research)** | **4** | 160 |

## B.Sc Microbiology
## Course Curriculum for All Semesters

### Semester I

| Sl. No. | Course Code | Course Title | Contact Hrs. / Week | | | Credit | Page No. |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| **Theory** | | | | | | | |
| 1. | | Major: Introduction to Microbiology and Microbial Diversity | 2 | 1 | | 3 | |
| 2. | | Minor: Chemistry | 2 | 1 | | 3 | |
| 3. | | MDC: Computer Fundamentals and Programming in R | 2 | 1 | | 3 | |
| 4. | | AEC: Communicative English | 2 | | | 2 | |
| 5. | | SEC: Biofertilizers and Biopesticides | 2 | 1 | | 3 | |
| 6. | | CVAC: Environmental Science | 2 | | | 2 | |
| **Practical** | | | | | | | |
| 7. | | Introduction to Microbiology and Microbial Diversity | | | 1 | 1 | |
| 8. | | Minor: Chemistry | | | 1 | 1 | |
| **Total Credit** | | | | | | **18** | |

# *Semester I*

**Core Subject:**

Course Name : INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY (Theory)
Course Code:
Course Outcome:
Course Details:

| Unit I: History of Development of Microbiology |
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| Development of microbiology as a discipline, Spontaneous generation vs. biogenesis. Contributionsof Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming.<br>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: 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 |
| Unit 3: 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.<br><br>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.<br><br>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.<br><br>Protozoa: General characteristics with special reference to Amoeba, Paramecium, Plasmodium, |

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| Leishmaniaand Giardia |
| Unit 4: Overview of Scope of Microbiology |
| Application of microbes in different areas of everyday use and research. |
| Suggested Reading |
| 1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education<br>2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition<br>3. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited<br>4. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9 Edition. McGraw Hill International.<br>5. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.<br>6. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.<br>7. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005).GeneralMicrobiology. 5 th edition. McMillan. |

Course Name : INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY (Practical)
Course Code:
Course Details:

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| 1. Microbiology Good Laboratory Practices and Biosafety.<br>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.<br>3. Preparation and inoculation of culture media for bacterial cultivation .<br>4. Study of Rhizopus, Penicillium, Aspergillus using temporary mounts<br>5. Study of Spirogyra and Chlamydomonas, Volvox using temporary Mounts<br>6. Study of the following protozoans using permanent mounts/photographs: Amoeba, Entamoeba, Paramecium and Plasmodium<br>7. Determination of size of microbial cell using micrometry.<br>8. Enumeration of microbes: Yeast by Haemocytometer |

**Skill Enhancement**
Course Name : Biofertilizers and Biopesticides (Theory)
Course Code:
Course Details:

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| Unit 1 Basics of Biofertilizers |
| Understanding the concept of biofertilizers, their types, and their role in enhancing soil fertility and plant nutrition. Various production methods for biofertilizers, including composting, vermicomposting, and the use of microbial cultures. General account of the microbes used as |

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| biofertilizers for various crop plants and their advantages over chemical fertilizers. |
| Unit 2 Symbiotic N2 fixers |
| Rhizobium - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants, Frankia- Isolation, characteristics, Alder, Casuarina plants, nonleguminous crop symbiosis, Azolla - Isolation, characterization, mass multiplication, role in rice cultivation, crop response, field application. |
| Unit 3 Non-Symbiotic Nitrogen Fixers |
| Free living Azospirillum, Azotobacter - isolation, characteristics, inoculum production and field application. |
| Unit 4 Phosphate Solubilizers |
| Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application |
| Unit 5 Mycorrhizal Biofertilizers |
| Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhiza and VAM. |
| Unit 6 Basics of Biopesticides |
| Introduction to biopesticides, their classification, and various sources and modes of action of biopesticides. |
| Unit 7 Bioinsecticides derived from microbes |
| Types of microbe-based bioinsecticides, their advantages over synthetic pesticides (target specificity, environmental safety, integrated pest management); Bacillus thuringiensis: toxin production and field applications, Nucleopolyhedroviruses (NPVs) – application and use |
| SUGGESTED READING |
| 1. Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS, Texas.<br>2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.<br>3. Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.<br>4. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH Publishing Co. Pvt. Ltd. NewDelhi.<br>5. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG<br>6. Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication. |

Course Name : Biofertilizers and Biopesticides (Practical)

Course Code:

Course Details:

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| Evaluation will be done internally on assignment and powerpoint presentation. |