TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India

Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

2-Year Master of Science (M.Sc.) Curriculum and Syllabus for Microbiology

First Semester

Course code	Course Name	L	P	T	Credits
TIU-PMB-T101	General Microbiology	3	0	0	3
TIU-PMB-T113	Bacterial physiology	3	0	0	3
TIU-PMB-T115	Phycology, Mycology and Virology	3	0	0	3
TIU-PMB-T107	Biochemistry	3	0	0	3
TIU-PMB-T109	Biophysics and Instrumentation	3	0	0	3
TIU-PMB-S101	CASD-Seminar presentation-Research paper	0	3	0	3
TIU-PMB-L101	General Microbiology Lab	0	2	0	2
TIU-PMB-L107	Biochemistry Lab	0	2	0	2
TIU-PMB-S109	Biophysics and Instrumentation Lab	0	2	0	2
TIU-PES-S197	**Entrepreneurship Skill Development (ESD)**	0	2	0	2
	Total Credits	**15**	**11**	**0**	**26**

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Semester I

TIU-PMB-T101	General Microbiology

1. History of microbiology.
2. Nomenclature and classification of microorganisms. General account of Cyanobacteria
3. Extremophile: anaerobes, halophiles, acidophile, alkalophile, tharmophile, barophile; Community structure and organization. Effect of heavy metal and xenobiotic substances on microbes; biological magnification of toxic substances.
4. Aeromicrobiology: Microbes of indoor and outdoor environment, pathways, enumeration, Extramural and intramural, control, bioterrorism. Eutrophication, Biosafety.
5. Water microbiology: Significance of microbes in water quality. Test for portability of water. Microbial treatment of sewage; application of wastewater in land; composting of biosolids and domestic solid waste.
6. Marine microbes and their applications.
7. Microorganism and metal pollutants; biodegradation of TNT, PCB; Bioremediation: bioventing, biofiltration, bioaugmentation, problems and advantages.
8. Bioleaching: mineral extraction, oil recovery.

Reference Books:

- Topley and Wilson's Principles of Bacteriology; Virology; and Immunity Graham Wilson.Williams
- & Wilkins; 7 edition (December 1983)
- Pelzer Microbiology
- Prescott Microbiology

TIU-PMB-T113	Bacterial physiology

1. Characterization of bacteria: (i) morphological: shape, Gram stain, endo-spore stain, capsule stain, acid-fast stain, flagella stain; (ii) cultural: growth in different carbon source (media); (iii) biochemical test: catalase, peroxidase, nitrate reduction, fermentation of sugar.

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2. Cultivation of bacteria: aerobic, anaerobic and facultative. Pure culture and its characteristics. Nutritional types. Enrichment culture technique for specific bacterial types: endospore forming, Nitrogen fixing, nitrifying, starch degrading, cellulose degrading, casein degrading, phosphate solubilizing. Unculturable and culturable bacteria-conventional, metagenomic approaches.

3. Strategies of cell division, growth kinetics, generation time, asynchronous, synchronous, batch, continuous culture, measurement of growth and factors affecting growth. Mechanism of cell divison.

4. Ultra-structure of bacteria: Cytoplasmic and outer membrane, capsule, flagella, pilli, endospore and special organelle. Gram-negative, Gram-positive and acid-fast bacteria. Wall deficient organism including L-form.

5. Cell wall synthesis, Flagellar synthesis.

Reference Books:

- Topley and Wilson's Principles of Bacteriology; Virology; and Immunity Graham Wilson.Williams
- & Wilkins; 7 edition (December 1983)
- Pelzer Microbiology
- Prescott Microbiology

TIU-PMB-T115	Phycology, Mycology and Virology

1. General account of algae, types of algae, Beneficial role of algae and pathologically important algae in bacteria, plant and animal, Anti algal agent.

2. General account of fungi, types of fungi, beneficial role of fungi and pathologically important fungi in bacteria, plant and animal, Anti-fungal agent.

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3. General account of Virus, types of Virus, Beneficial role of Virus-Phagetherapy and pathologically important virus in bacteria, plant and animal, Anti-Viral agent
4. Special microorganism: Mycorrziza, Lichen
5. Virion, Viroid, prion

Reference Books:

- Arora, D.R. and Brij Bala Arora. *Medical Mycology*. New Delhi: CBS Publishers, 2013.
- Alexopolous, J. and W. M. Charles. 1988. Introduction to Mycology. Wiley Eastern,New Delhi.
- Mckane, L. and K. Judy.1996. Microbiology–Essentials and Applications. McGraw Hill, NewYork.
- Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
- Pandey, B. P.2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
- Sambamurthy, A. V. S. S.2006. A Textbook of Plant Pathology. I.K. International Pvt. Ltd., New Delhi.
- Sambamurthy, A. V. S. S.2006. ATextbook of Algae. I. K. International Pvt. Ltd., New Delhi.
- Sharma, O. P.1992. Textbook of Thallophyta. McGraw Hill Publihing Co., New Delhi.

TIU-PMB-T107	Biochemistry

1. Structure of atoms, molecules and chemical bonds.
2. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
3. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).
4. Stablizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).
5. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes

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6. Bioenergetics, glycolysis, TCA, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.

Reference books

- Cell (A Molecular approach): Cooper, G. M.
- Cell and Molecular Biology (1996) Karp, G.
- Cell and Molecular Biology: deRobertis and deRobertis
- Principle of Biochemistry: Leninger , A. L.
- Biochemistry (1995) Lubert Stryer

TIU-PMB-T109	Biophysics and Instrumentation

1. Microscopy: Principle and applications of light, phase contrast and fluorescence, Electron microscopy -scanning, transmission, confocal, atomic force microscope. Methods of sample processing for EM.

2. Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.
3. Chromatography- TLC, ion exchange, affinity, reverse phase, gel filtration. Principle and application of High Performance Liquid Chromatography, Fast protein liquid chromatography, ELISA-Reader, Autoanalyzer, FACS,

4. Electrophoresis – principle, paper, gel, SDS PAGE.

Reference books:

- Bioanalytical Chemistry (Susan R. Mikkelsen and Eduardo Cortón; Wiley-Interscience; 2004; ISBN 0-471-54447-7

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- Biophysical Chemistry- Friedfielder
- Spectrometric Identification of Organic compounds by R M Silverstein and F X Webster; Sixth edition (2002)
- Introduction to Spectroscopy by D Pavia; G Lampman; G Kriz; Second edition (1996)

TIU-PMB-S201	CASD-Scientific writing

TIU-PMB-L101	General Microbiology Lab

1. Preparation of culture media
2. Isolation of pure culture by a streak plate preparation
3. Isolation of pure culture by a pour plate preparation
4. Yeast and mold isolation
5. Operation of light microscopy
6. Simple staining
7. Gram staining
8. Isolation of bacteria from water sample by a pour plate technique
9. Growth curve of bacteria

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TIU-PMB-L107	Biochemistry Lab

1. Estimation of total carbohydrate, protein of a bacterial cell.
2. Estimation of total DNA and RNA of a bacterial cell.
3. Coagulase tests, Catalase Tests, Oxidase test, Indole test, Methyl Red test, Urease Test, Biochemical reactions on triple sugar iron agar (TSI).
4. Determination of activity of amylase, protease. Effect of pH, temperature on enzyme activity; Enzyme kinetics.
5. Determination of MW of protein by PAGE.

TIU-PMB-L109	Biophysics and Instrumentation Lab

1. Microbiology laboratory rules
2. Basic tools in a microbiological laboratory.
3. Basic equipments in laboratory
4. Microscopy: Light microscopy, Phase contrast microscopy, Fluorescence microscopy
5. Laminar air flow, Autoclave, Hot air oven.
6. Incubator, Orbital shaking incubator,Water bath
7. Weighing balance, Ph meter, Centrifuge machine, Distillation apparatus.
8. Spectrophotometer
9. Agarose gel electrophoresis, Uv-transilluminator
10. Polyacrylamide gel electrophoresis (PAGE) and Gel documentation System
11. Sonicator

TIU-PES-S197	**Entrepreneurship Skill Development (ESD)**