TECHNO INDIA UNIVERSITY
WEST BENGAL

SEMESTER 2

Department of Microbiology, Basic of Pathology (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Basic of Pathology (Theory)	**Subject Code:**TIU-PMB-T112
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand Human and Plant-Microbe Interactions
2. Analyze Antibacterial Agents and Drug Resistance
3. Apply Hematological Techniques in Laboratory Practice

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Describe the normal flora of the human body	K1
CO-2:	Classify bacterial toxins and their mechanisms	K2
CO-3:	Evaluate methods of bacterial control and drug resistance	K5
CO-4:	Analyze plant responses to biotic and abiotic stress	K4
CO-5:	Demonstrate hematology techniques in clinical settings	K3
CO-6:	Explain blood circulation and immune mechanisms	K2

COURSE CONTENT:

MODULE 1:	**Flora of human body**	**9 Hours**
Normal flora of human body, Bacterial toxins, toxicity and pathogenesis		
MODULE 2:	**Antibacterial substances**	**9 Hours**
Antibacterial substances and drug resistance: Control of bacterial growth - physical and chemical agents, preservation methods, stress responses		

MODULE 3:	**Host-parasite relationship**	**9 Hours**
Host-parasite relationship: Host range of pathogens, Koch's postulate and phenomenon; normal flora, parasitism and pathogenicity, routes of infection, virulence factor and chemical mediators, toxicity and pathogenesis		
MODULE 4:	**Plant pathology**	**9 Hours**
Plant pathology – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses		
MODULE 5:	**Hematology**	**9 Hours**
Basic hematology, laboratory organization and safety measures and waste management. Anticoagulants, sample collection techniques, preservation, transport and handling		
MODULE 6:	**Blood and circulation**	**9 Hours**
Blood and circulation - Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis		
TOTAL LECTURES		**45 Hours**

Books:

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.

2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.

3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications, 1999.

4. Fundamental of Immunology, 4th edition, Lippencott Raven, 1999

Department of Microbiology, Environment and Food Microbiology (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Environment and Food Microbiology (Theory)	**Subject Code:**TIU-PMB-T114
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand Ecological Interactions and Ecosystem Dynamics
2. Analyze Biodiversity and Conservation Strategies
3. Apply Microbiological Principles in Food Safety and Fermentation

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Describe ecological and environmental factors	K1
CO-2:	Classify ecosystem components and energy flow	K4
CO-3:	Assess biodiversity conservation approaches	K5
CO-4:	Explain food spoilage and preservation methods	K2
CO-5:	Demonstrate microbial roles in food fermentation	K3
CO-6:	Analyze foodborne pathogens and diseases	K4

COURSE CONTENT:

MODULE 1:	**Environmental complex**	**5 Hours**
Environmental complex, interaction of ecological factors: light, temperature, precipitation (rainfall), humidity of air, atmospheric gases and wind; topographical factors; edaphic factors		
MODULE 2:	**Ecosystem**	**5 Hours**
Ecosystem management. Concept of ecosystem and ecosystem management, trophic structure of the ecosystem; ecotones and edges; ecosystem diversity; classification of ecosystems; stability of ecosystem; examples of ecosystem: A pond; agroecosystem. Energy flow through ecosystem, energy environment		
MODULE 3:	**Productivity**	**5 Hours**
Concept of productivity; energy partitioning in food chain and food webs		
MODULE 4:	**Population**	**5 Hours**
Population properties, density dependent and density independent mechanism of population regulation. Concept of habitat and niche, r and k selection		
MODULE 5:	**Biodiversity**	**5 Hours**
Types of interactions between two species; co-evolution.Biodiversity		
MODULE 6:	**Conservation**	**5 Hours**
Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy.		
MODULE 7:	**Spoilage and Preservation of food**	**5 Hours**

Microorganisms associated with food (milk, meat, fish, cereals, vegetables and fruits).Spoilage of foods, maintenance of food sterility and preservatives.Food preservation methods: physical, synthetic, natural and biological.		
MODULE 8:	**Food processing**	**5 Hours**
Microbial food processing: role of indicating microorganisms like lactic acid and other bacteria yeast and molds. Starter cultures. Lactic acid, bacterocins and other metabolites, their applications		
MODULE 9:	**Fermented food**	**Hours**
Fermented food: Production and beneficial effects. Food deterioration by mycotoxins. Characteristics of food borne diseases caused by Clostridium, E. coli, Listeria, Salmonella,Shigella		
TOTAL LECTURES		**45 Hours****

Books:

1. Microbiology: Michael Pelczar, E.C.S Chan, Noel R. Krieg; Tata McGraw - Hill Education (2001); 5th Edition.
2. General Microbiology: Author: Hans Gunter-schlegel, Schlegel Hans Gunter, Hans Gunter
3. Schlegel; Cambridge University Press (1993); 7th Revised Edition Topley and Wilson's Principles of Bacteriology; Virology; and Immunity Graham Wilson.

Department of Microbiology, Biological evolution (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Biological evolution (Theory)	**Subject Code:**TIU-PMB-T122
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand the Foundations of Evolutionary Theory
2. Explore the Molecular and Genetic Basis of Evolution
3. Apply Evolutionary Concepts to Biodiversity and Adaptation

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Explain major evolutionary theories	K1
CO-2:	Analyze the origin of life and unicellular evolution	K4
CO-3:	Describe the evolutionary timeline and fossil record	K1
CO-4:	Apply molecular evolution concepts	K3
CO-5:	Evaluate mechanisms of evolutionary change	K5
CO-6:	Investigate patterns of adaptation and co-evolution	K6

COURSE CONTENT:

MODULE 1:	**Introduction**	**7 Hours**
Emergence of evolutionary thoughts		
MODULE 2:	**Theory**	**7 Hours**
Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; The evolutionary synthesis		
MODULE 3:	**Origin of cells**	**7 Hours**
Origin of cells and unicellular evolution: Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiement of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic metabolism, photosynthesis and aerobic metabolism		
MODULE 4:	**Evolutionary History**	**8 Hours**
Paleontology and Evolutionary History: The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multi cellular organisms; Major groups of plants and animals; Stages in primate evolution including Homo.		
MODULE 5:	**Molecular Evolution**	**8 Hours**
Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; origin of new genes and proteins; Gene duplication and divergence		
MODULE 6:	**Mechanisms**	**8 Hours**
The Mechanisms: Population genetics – Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.		
TOTAL LECTURES		**45 Hours**

Books:

1. Microbiology: Michael Pelczar, E.C.S Chan, Noel R. Krieg; Tata McGraw - Hill Education (2001); 5th Edition.

2. General Microbiology: Author: Hans Gunter-schlegel, Schlegel Hans Gunter, Hans Gunter

3. Schlegel; Cambridge University Press (1993); 7th Revised Edition Topley and Wilson's Principles of Bacteriology; Virology; and Immunity Graham Wilson.

Department of Microbiology, Biostatistics and Bioinformatics (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Biostatistics and Bioinformatics (Theory)	**Subject Code:**TIU-PMB-T120
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand Statistical and Bioinformatics Principles
2. Develop Data Analysis and Computational Skills
3. Analyze Gene Regulatory and Computational Models

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Explain measures of central tendency and probability distributions	K1
CO-2:	Perform hypothesis testing and statistical analysis	K3
CO-3:	Interpret bioinformatics algorithms for sequence analysis	K3
CO-4:	Apply molecular phylogeny techniques	K3
CO-5:	Evaluate gene regulatory networks and computational models	K5
CO-6:	Develop skills in ligand-protein interaction studies	K6

COURSE CONTENT:

MODULE 1:	**Measures of central tendency**	**7 Hours**

Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal)		
MODULE 2:	**Sampling**	**8 Hours**
Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors;Levels of significance; Regression and Correlation; t-test; Analysisof variance; X2 test		
MODULE 3:	**Statistics**	**7 Hours**
Basic introduction toMuetrovariate statistics, etc		
MODULE 4:	**Bioinformatics**	**7 Hours**
Biological sequence database.Sequence comparison, pairwise alignment, multiple alignment		
MODULE 5:	**Database**	**8 Hours**
Mutation matrix and its application. Database searching, algorithms of FASTA and BLAST		
MODULE 6:	**Molecular phylogeny**	**8 Hours**
Basic molecular phylogeny. Ligand protein interaction		
MODULE 7:	**Gene regulatory networks**	**5 Hours**
Gene regulatory networks : Dynamic nature of *E. coli* genome, Transcriptional network in *S. cerevisiae*, Mathematical modeling and computer simulation		
TOTAL LECTURES		**45 Hours****

Books:

1. Basotia, G.R. and K.K. Sharma. Research Methodology. Chaudhary, C.H. Research Methodology. RBSA Publications. Daniell, W. Elements of Biostatistics in Health Sciences.
2. Singh, S et al. Statistical Methods for Research. Ludhiana: Central Publishing. Enhance, D.N. Fundamentals of Statistics.
3. Gupta, S.P. Statistical Methods. New Delhi: S. Chand.
4. Khan and Khanna. Fundamentals of Biostatistics. Ukaz Publication Zerold and Jar. Biostatistical Analysis.
5. Bioinformatics: Sequence and Genome Analysis, Second Edition (2004) D. Mount, Cold Spring Harbor Laboratory Press, New York

Department of Microbiology, Career Advancement Skill Development (CASD)

Program: M. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Career Advancement Skill Development (CASD)	**Subject Code:** TIU-PMB-S100
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Develop Effective Communication Skills
2. Enhance Linguistic Proficiency
3. Improve Professional and Academic Writing

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Explain fundamental concepts of communication	K1
CO-2:	Analyze the role of language in communication	K4
CO-3:	Use appropriate language in different contexts	K3
CO-4:	Demonstrate proficiency in professional writing	K6
CO-5:	Evaluate different writing styles	K5
CO-6:	Enhance clarity and coherence in writing	K3

COURSE CONTENT:

MODULE 1:	**Concepts**	**17 Hours**
Concepts in Communication: Communication as sharing; context of communication; the speaker/writer and the listener/reader; medium of communication; barriers to communication; accuracy, brevity, clarity and appropriateness in communication; Non-verbal skills, Paralanguage and Body language		
MODULE 2:	**Semantics**	**14 Hours**
Semantics: A selected list of Synonyms, Antonyms, Homophones and Homonyms. Form and function of words. Syntax: Sentence structures, Verb patterns and their usage		
MODULE 3:	**Writing Skills**	**14 Hours**

Writing Skills: Types of writing (Expository, Descriptive, Analytic, Argumentative, Narrative etc) and their main features. Resumes and CV's and Cover letters. Memos and Notices. Basics of Formal Reports	
TOTAL LECTURES	**45 Hours**

Department of Microbiology, Pathology (Practical)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Pathology (Practical)	**Subject Code:**TIU-PMB-L112
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 1

COURSE OBJECTIVE:

Enable the student to:

1. Understand Antimicrobial Susceptibility Testing
2. Develop Skills in Microbial Interaction and Biofilm Studies
3. Analyze the Kinetics of Bacterial Death and Antimicrobial Action

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Explain the principles of antimicrobial testing	K1
CO-2:	Perform MIC and MBC determination assays	K3
CO-3:	Evaluate bacterial death kinetics	K4
CO-4:	Conduct disk diffusion and cross-streak antagonism assays	K3
CO-5:	Investigate biofilm formation mechanisms	K5
CO-6:	Develop strategies for biofilm inhibition	K6

COURSE CONTENT:

MODULE 1:	**Study of microbial pathogenicity**	**30 Hours**

1. Determination of MIC 2. Determination of MBC and tolerance of an antibacterial agent 3. Death kinetic assay 4. Disk diffusion assay 5. Antagonistic activity of bacteria against fungi by Cross streak method 6. Biofilm formation 7. Biofilm inhibition by antibiofilm agent

TOTAL LECTURES	**30 Hours**

Department of Microbiology, Environmental and Food Microbiology(Practical)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Environmental and Food Microbiology (Practical)	**Subject Code:**TIU-PMB-L114
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE:

Enable the student to:

1. Develop Practical Skills in Microbial Analysis
2. Analyze Environmental and Agricultural Microbiology
3. Evaluate Microbial Contributions to Food and Health

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Explain water quality assessment techniques	K1
CO-2:	Perform soil microbial isolation and characterization	K3
CO-3:	Demonstrate microbial-based composting technique	K3
CO-4:	Analyze probiotic characteristics of lactic acid bacteria	K3
CO-5:	Assess microbial enzyme activity in dairy products	K5
CO-6:	Apply microbial techniques in food preservation	K6

COURSE CONTENT:

MODULE 1:	**Study of microbial characteristics**	**30 Hours**

1. Testing of water sample to determine microbial load in the different places of urban/ rural locality. Enumeration of coliform bacteria (total and fecal) of water through multiple tube fermentation technique (MPN).
2. Determination of Biochemical Oxygen Demand(BOD)
3. Identification of enteric bacilli by IMViC Test
4. Isolation of Phosphate solubilising bacteria from soil.
5. Isolation of free living Nitrogen fixing bacteria from soil
6. Production of vermicompost. Enumeration of microbes and level of N, P, & K before and after composting
7. Production and estimation of IAA from microorganism
8. Methylene Blue reductase test
9. Determination of phosphatase activity of milk.
10. Isolation of Lactic acid bacteria(LAB) from milk
11. Determination of probiotic activity of LAB: pH tolerance, aggregation, autoaggregation, coaggregation and hydrophobicity
12. Preservation of food by using preservative sodium benzoate

TOTAL LECTURES	**30 Hours**

Department of Microbiology, Entrepreneurship Skill Development (ESD)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Entrepreneurship Skill Development (ESD)	**Subject Code:**TIU-PES-S198
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit: 2**

COURSE OBJECTIVE:

Enable the student to:

1. Understand Entrepreneurial Concepts
2. Enhance Business Planning and Management Skills
3. Develop Innovation and Problem-Solving Abilities

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Explain key entrepreneurial concepts	K1
CO-2:	Identify and evaluate business opportunities	K4
CO-3:	Demonstrate business planning skills	K3
CO-4:	Assess financial and resource management strategies	K5

CO-5:	Develop innovative solutions to entrepreneurial challenges	K6
CO-6:	Apply leadership and decision-making skills	K3

COURSE CONTENT:

MODULE 1:	**Entrepreneurship Skills**	**30 Hours**
Development of Entrepreneurship Skills		
TOTAL LECTURES		**30 Hours**

Department of Microbiology, Training and Seminar Presentation

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: Training and Seminar Presentation)	**Subject Code:**TIU-PMB-S122
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit: 2**

COURSE OBJECTIVE:

Enable the student to:

1. Enhance Presentation and Communication Skills
2. Strengthen Research and Analytical Thinking
3. Develop Professional and Collaborative Competencies

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Explain key concepts in scientific communication	K2
CO-2:	Demonstrate proficiency in seminar presentation	K3
CO-3:	Analyze and critique research findings	K4
CO-4:	Develop well-structured reports and presentations	K6
CO-5:	Apply public speaking and interpersonal skills	K3
CO-6:	Assess the impact of audience interaction and feedback	K5

COURSE CONTENT:

MODULE 1:	**Working skills Skills**	

Development of working skills	
TOTAL LECTURES	