TECHNO INDIA UNIVERSITY
WEST BENGAL

SEMESTER 3

Department of Microbiology, Cell Biology (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 2nd Yr., 1st Sem
Course Title: Cell Biology (Theory)	**Subject Code:**TIU-PMB-T211
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand Membrane and Cellular Structures
2. Analyze Cell Cycle and Signaling Mechanisms
3. Evaluate Gene Expression and Its Regulation

COURSE OUTCOME:

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

CO-1:	Describe membrane structure and transport mechanisms	K1
CO-2:	Illustrate the structure and function of cell organelles	K2
CO-3:	Demonstrate knowledge of cell cycle regulation	K3
CO-4:	Analyze cellular signaling pathways	K4
CO-5:	Assess transcriptional and translational control of gene expression	K5
CO-6:	Apply chromatin modification concepts to gene expression and silencing	K6

COURSE CONTENT:

MODULE 1:	**Membrane**	**9 Hours**
Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes		

MODULE 2:	**Cell Organelles**	**9 Hours**
Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, structure & function of cytoskeleton and its role in motility		
MODULE 3:	**Cell cycle**	**9 Hours**
Cell cycle, regulation and control of cell cycle		
MODULE 4:	**Cell signaling**	**9 Hours**
Cell signaling through G-protein coupled receptors. Receptor Tyrosinekinase, Apoptosis		
MODULE 5:	**Gene expression**	**9 Hours**
Control of gene expression at transcription and translation level: regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing		
TOTAL LECTURES		**45 Hours**

Books:

1. Genomics and Genetic Engineering By Satya; Pratik New India Publishing Agency (2007)

2. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.

3. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.

4. Brown TA, Genomes, 3rd ed. Garland Science 2006

5. Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc

Department of Microbiology, Biological Method (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: Biological Method (Theory)	**Subject Code:**TIU-PMB-T213
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand Techniques for Isolation and Analysis of Macromolecules
2. Develop Skills in Molecular Cloning, Expression, and Mutagenesis
3. Explore Advanced Sequencing and Genomic Applications

COURSE OUTCOME:

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

CO-1:	Explain macromolecule isolation techniques	K1
CO-2:	Demonstrate gel electrophoresis techniques for molecular analysis	K3
CO-3:	Construct recombinant DNA using molecular cloning techniques	K3
CO-4:	Analyze recombinant protein expression and genomic library construction	K4
CO-5:	Assess the impact of gene mutagenesis and knockout studies	K5
CO-6:	Apply genome sequencing and transgenic technologies in research	K6

COURSE CONTENT:

MODULE 1:	**Isolation and purification of Macromolecules**	**7 Hours**
Isolation and purification of RNA , DNA (genomic and plasmid) and proteins		
MODULE 2:	**Analysis ofMacromolecules**	**7 Hours**
Different separation methods.Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels		
MODULE 3:	**Cloning**	**7 Hours**
Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems		
MODULE 4:	**Expression**	**8 Hours**
Expression of recombinant proteins using bacterial, animal and plant vectors.Isolation of specific nucleic acid sequences. Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors.		
MODULE 5:	**Mutagenesis**	**8 Hours**
In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms. Genomics and its application to health and agriculture, including gene therapy		
MODULE 6:	**Sequencing Methods**	**8 Hours**

Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing.Tissue and cell culture methods for plants and animals. Transgenic animals and plants	
TOTAL LECTURES	**45 Hours**

Books:

1. Genes VIII: Benjamin Lewin
2. Molecular Biology of Gene: Watson et al. Cell & Molecular Biology: Lodish et al.
3. Molecular Biology of cell – Bruce Alberts et al., Garland Publications Sambrooket al (2000)
4. Molecular Cloning Volumes I, II, & III Cold spring Harbor Laboratory Press, New York, US

Department of Microbiology, Immunology and Cancer (Theory)

Program:M. Sc. in Microbiology	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: Immunology and Cancer (Theory)	**Subject Code:**TIU-PMB-T215
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand the Fundamental Concepts of Immunology
2. Analyze Immune System Functions and Dysfunctions
3. Apply Immunological Techniques in Research and Medicine

COURSE OUTCOME:

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

CO-1:	Explain the structure and functions of immunoglobulins	K1
CO-2:	Demonstrate the process of B and T cell maturation, activation, and differentiation	K3
CO-3:	Analyze the functions of cytokines in immune responses	K4
CO-4:	Assess the causes and effects of autoimmunity and immunodeficiency diseases	K5
CO-5:	Investigate cancer immunology and transplantation immunology	K2

CO-6:	Develop monoclonal and polyclonal antibodies for therapeutic applications	K6

COURSE CONTENT:

MODULE 1:	**Immunoglobins**	**6Hours**
Immunoglobins, organization and expressions of Ig genes		
MODULE 2:	B cell	**6 Hours**
B cell maturation, activation and differentiation; MHC/HLA; antigen processing and presentation		
MODULE 3:	**T cells**	**6Hours**
T cells, T cell receptors, Tcell maturation, activation and differentiation		
MODULE 4:	**Cytokines**	**7Hours**
Cytokines; cell mediated and humoral effector responses		
MODULE 5:	**Autoimmunity**	**6 Hours**
Autoimmunity, immunodeficiency diseases		
MODULE 6:	**Cancer**	**7 Hours**
Transplantation immunology, Cancer and immune system		
MODULE 7:	**Antibodies**	**7 Hours**
Monoclonal and polyclonal antibodies, monoclonal antibody technique		
TOTAL LECTURES		**45 Hours**

Books:

1. Kuby Immunology

Department of Microbiology, DNA Metabolism and Gene regulation (Theory)

Program:M. Sc. in Microbiology	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title:DNA Metabolism and Gene regulation (Theory)	**Subject Code:**TIU-PMB-T221
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Master the Mechanisms of DNA Replication and Repair
2. Analyze Transcriptional Processes and RNA Processing
3. Evaluate the Processes of Translation and Gene Expression Regulation

COURSE OUTCOME:

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

CO-1:	Describe the Mechanisms of DNA Replication and Repair	K2
CO-2:	Analyze DNA Damage and Recombination Processes	K4
CO-3:	Interpret Transcription Initiation and RNA Processing	K4
CO-4:	Evaluate Ribosomal Function and Translational Mechanisms	K5
CO-5:	Apply Knowledge of Translational Inhibition and tRNA Identity	K3
CO-6:	Design Strategies for Regulating Gene Expression	K6

COURSE CONTENT:

MODULE 1:	**Replication**	**15 Hours**
Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination		
MODULE 2:	**Transcription**	**10 Hours**
Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport		
MODULE 3:	**Translation**	**10 Hours**
Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins.		

MODULE 4:	Gene expression	10 Hours
Control of gene expression at transcription and translation level: regulating the expression of phages, viruses, prokaryotic and eukaryotic genes		
TOTAL LECTURES		**45 Hours**

Books:

1. Genes VIII: Benjamin Lewin
2. Molecular Biology of Gene: Watson et al.
3. Cell & Molecular Biology: Lodish et al.
4. Molecular Biology of cell – Bruce Alberts et al., Garland Publications Sambrooket al (2000)
5. Molecular Cloning Volumes I, II, & III Cold spring Harbor Laboratory Press, New York, US

Department of Microbiology, Medical and Diagnostic Technology (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: Medical and Diagnostic Technology (Theory)	**Subject Code:**TIU-PMB-T219
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand Automation and Modern Diagnostic Techniques in Microbiology
2. Analyze Emerging Infectious Diseases and Detection Methods
3. Examine Bioterrorism and Culture Techniques for Pathogen Identification

COURSE OUTCOME:

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

CO-1:	Explain automation in microbiology and immunoprophylaxis	K1
CO-2:	Demonstrate molecular and serological detection methods	K3
CO-3:	Identify and assess emerging infectious diseases	K2
CO-4:	Evaluate the threat of bioterrorism and proper specimen collection techniques	K5
CO-5:	Apply culture techniques for pathogen isolation from clinical samples	K3

CO-6:	Analyze ribotyping and its application in microbial identification	K4

COURSE CONTENT:

MODULE 1:	**Automation**	**15 Hours**
Automation in Microbiology, Immunoprophylaxis against diseases		
MODULE 2:	**Emerging infectious diseases**	**10 Hours**
Emerging infectious diseases and detection by modern techniques like ELISA, RIA, Histochemistry, RFLP, RAPD, Mantu, Microarray, PCR etc		
MODULE 3:	**Bioterrorism**	**10 Hours**
Bioterrorism, Collection of specimens for bacteriological investigations		
MODULE 4:	**Methods of culture**	**10 Hours**
Methods of culture, techniques and organisms encountered in: CSF, blood culture, sputum, pus, urine, stool, UTI, endocarditis, Bone and joint infections. Ribotyping		
TOTAL LECTURES		**45 Hours**

Books:

1. Bailey and Scott's Diagnostic Microbiology. 9th ed. St. Louis: C.V. Mosby, 2003.
2. Koneman, E.W., S.O. Allen, P.C. Schreckenberg, and W.C. Winn, eds.
3. Atlas and Textbook of Diagnostic Microbiology. 4th ed. Philadelphia: J.B. Lippincott, 1992.
4. Murray, P.R, E.J. Baron, M.A. Pfaller, P.C. Tenover, and R.H. Yolken, eds.
5. Manual of Clinical Microbiology. 6th ed. Washington DC: American Society for Microbiology, 2005.

Department of Microbiology, CASD

Program: M. Sc. in Microbiology	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: CASD	**Subject Code:** TIU-PMB-S201

Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand the Fundamentals of LaTeX
2. Apply LaTeX for Technical and Academic Writing
3. Enhance Document Presentation with Advanced Features

COURSE OUTCOME:

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

CO-1:	Explain the structure and workflow of LaTeX	K1
CO-2:	Format structured documents efficiently	K3
CO-3:	Typeset mathematical equations and symbols	K3
CO-4:	Design tables, figures, and references effectively	K4
CO-5:	Optimize document styling with advanced LaTeX features	K5
CO-6:	Develop professional research papers and presentations	K6

COURSE CONTENT:

MODULE 1:	**LATEX**	**45 Hours**
Technical training based on LATEX		
TOTAL LECTURES		**45 Hours**

Department of Microbiology, Cell Biology (Practical)

Program: M. Sc. in Microbiology	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: Cell Biology (Practical)	**Subject Code:**TIU-PMB-L211
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE:

Enable the student to:

1. Understand Cell Culture and Microscopy Techniques
2. Apply Cell Viability and Functional Assays
3. Analyze Cellular Responses Using Advanced Techniques

COURSE OUTCOME:

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

CO-1:	Describe fundamental cellular structures and microscopy techniques	K1

CO-2:	Demonstrate aseptic techniques for cell culture	K3
CO-3:	Conduct cell viability assays (MTT assay, Acridine Orange/EtBr staining)	K3
CO-4:	Analyze oxidative stress and membrane permeability using flow cytometry	K4
CO-5:	Interpret fluorescence microscopy results for cell viability	K5
CO-6:	Apply cellular techniques in biomedical and toxicological research	K6

COURSE CONTENT:

MODULE 1:	**Study of cells**	**30 Hours**
1. Microscopic observation of cellular structure. 2. Cell culture techniques 3. Cell viability test-MTT assay 4. Cell permeability and ROS generation by Flow cytometry study 5. Fluorescence microscopic study of cell viability by Acridine orange EtBr staining		
TOTAL LECTURES		**30 Hours**

Department of Microbiology, MolecularBiology (Practical)

Program: M. Sc. in Microbiology	**Year, Semester: 2**nd Yr., 3rd Sem
Course Title: Molecular Biology (Practical)	**Subject Code:**TIU-PMB-L223
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE:

Enable the student to:

1. Develop a Theoretical and Practical Understanding of DNA Isolation Techniques
2. Acquire Proficiency in Molecular Cloning Procedures
3. Integrate and Analyze Molecular Techniques for Genetic Experimentation

COURSE OUTCOME:

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

CO-1:	Describe the Principles of DNA Isolation from Bacteria	K2
CO-2:	Perform and Compare DNA Isolation Techniques	K3
CO-3:	Prepare Competent Bacterial Cells	K3

CO-4:	Execute Bacterial Transformation Protocols	K4
CO-5:	Conduct Restriction Digestion of DNA Samples	K3
CO-6:	Analyze DNA Fragments Using Agarose Gel Electrophoresis	K4

COURSE CONTENT:

MODULE 1:	**Study of different molecular characteristics of cell**	**30 Hours**
1. DNA isolation from bacteria 2. Plasmid DNA isolation from bacteria. 3. Competent cell preparation 4. Transformation 5. Restriction digestion 6. Agarose gel electrophoresis		
TOTAL LECTURES		**30 Hours****

Department of Microbiology, Medical and Diagnostic Micro Bio (Practical)

Program: M. Sc. in Microbiology	**Year, Semester: 2**nd Yr., 3rd Sem
Course Title: Medical and Diagnostic Micro Bio (Practical)	**Subject Code:**TIU-PMB-L203
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE:

Enable the student to:

1. Understand Molecular and Immunological Techniques
2. Apply Hematological and Immunological Methods in Laboratory Analysis
3. Analyze and Interpret Results from Molecular and Immunodiagnostic Techniques

COURSE OUTCOME:

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

CO-1:	Explain the principles of molecular and immunological techniques	K1
CO-2:	Perform manual WBC counting using a hemocytometer	K3
CO-3:	Determine the blood group of an individual using standard protocols	K3
CO-4:	Demonstrate immunoelectrophoresis and immunodiffusion techniques	K3

CO-5:	Analyze experimental results from electrophoretic and immunological tests	K4
CO-6:	Evaluate the role of these techniques in research and diagnostics	K5

COURSE CONTENT:

MODULE 1:	**Study of different molecular techniques**	**30 Hours**
1. PCR 2. Manual count of white blood cell (WBC's) using a hemocytometer 3. Determination of the blood group of an individual 4. Techniques of immunoelectrophoresis(SDS PAGE) 5. Oucterlony double diffusion technique. 6. Precipitation techniques: immunodiffusion 7. Immuno-electrophoretic method (Western Blot)		
TOTAL LECTURES		**30 Hours**

Department of Microbiology, Entrepreneurship Skill Development (ESD)

Program: M. Sc. in Microbiology	**Year, Semester: 2**nd Yr., 3rd Sem
Course Title: Entrepreneurship Skill Development (ESD)	**Subject Code:**TIU-PES-S297
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**