



TECHNO INDIA UNIVERSITY
WEST BENGAL

Syllabus for 2-year M.Sc in Microbiology

Department of Microbiology

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



Course Curriculum For All Semester :

M.Sc in Microbiology

Semester III

Sl. No.	Course Code	Course Title	Contact Hrs. / Week			Credit	Page No.
			L	T	P		
Theory							
1	TIU-PMB-T211	Cell Biology	2	1	0	3	
2	TIU-PMB-T213	Biological Methods	2	1	0	3	
3	TIU-PMB-T215	Immunology and Cancer	2	1	0	3	
4	TIU-PMB-T221	DNA Metabolism and Gene regulation	2	1	0	3	
5	TIU-PMB-T219	Medical and Diagnostic Technology	2	1	0	3	
6	TIU-PMA-L201	CASD (Lab)	2	1	0	3	
Practical							
1	TIU-PMB-L211	Cell biology lab	0	0	2	2	
2	TIU-PMB-L203	Molecular Biology Lab	0	0	2	2	
3	TIU-PMB-L205	MedicalandDiagnostic Microbiology Lab	0	0	2	2	
4	TIU-PES-S297	Entrepreneurship Skill Development (ESD)	0	0	2	2	
Total Credit						26	



Syllabus for M.Sc in Microbiology
Department of Microbiology
Techno India University, West Bengal

Semester III

Course Name: Cell Biology (Theory)

Course Code: TIU-PMB-T211

Course Outcome:

- Understand how complex cellular processes are regulated and coordinated.
- Analyze the structure and function of diverse organelles and macromolecules.
- Describe how genetic information is expressed, inherited, and modified.
- Evaluate the impact of mutations and other genetic abnormalities on cellular function.
- Analyze the impact of cellular processes on development and disease.
- Develop and apply methods to characterize and manipulate cells.
- Interpret and analyze data from the study of cell biology.
- Communicate the findings of cell biology research effectively.

Course Contents:

- 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.
- Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, structure & function of cytoskeleton and its role in motility
- Cell cycle, regulation and control of cell cycle
- Cell signaling through G-protein coupled receptors. Receptor Tyrosinekinase, Apoptosis
- 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

Reference Books:

- Genomics and Genetic Engineering By Satya; Pratik New India Publishing Agency (2007)
- S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.
- J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
- Brown TA, Genomes, 3rd ed. Garland Science 2006
- Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.



Course Name: Biological Method (Theory)

Course Code: TIU-PMB-T213

Course Outcome:

- Develop an understanding of the principles that govern the behavior of biological systems.
- Interpret and analyze experimental results in the context of physical principles.
- Design experiments to test hypotheses about biological systems.
- Employ quantitative techniques to study biological systems.
- Apply principles to solve problems in medicine, biology and biotechnology.
- Communicate scientific concepts and results to a variety of audiences.

Course Contents:

- Isolation and purification of RNA , DNA (genomic and plasmid) and proteins,
- Different separation methods.
- Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels.
- Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems.
- 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.
- 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.
- 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

Reference Books:

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

Course Name: Immunology and Cancer (Theory)

Course Code: TIU-PMB-T215

Course Outcome:

- The Course outcome of immunology typically includes a thorough understanding of the components and mechanisms of the human immune system, including its structure and function, as well as its response to foreign substances and its role in disease.



- Students should be able to explain the different types of immune cells, their respective roles and the interactions between them that make up the immune system.
- They should also be able to identify and explain the various types of immunologic tests used in clinical settings and their respective purpose.
- Students should be able to describe the role of immunology in the diagnosis, treatment, and prevention of infectious and non-infectious diseases.
- Students should be able to identify and discuss the ethical and social implications of immunological research.

Course Contents:

- Immunoglobins, organization and expressions of Ig genes;
- B cell maturation, activation and differentiation; MHC/HLA; antigen processing and presentation.
- T cells, T cell receptors, Tcell maturation, activation and differentiation.
- Cytokines; cell mediated and humoral effector responses.
- Autoimmunity, immunodeficiency diseases,
- Transplantation immunology
- Cancer and immune system.
- Monoclonal and polyclonal antibodies, monoclonal antibody technique

Reference Books:

- Kuby Immunology

Course Name: DNA Metabolism and Gene regulation (Theory)

Course Code: TIU-PMB-T221

Course Outcome:

- Develop an understanding of the molecular basis of life and its implications for the diagnosis, treatment and prevention of disease.
- Recognize, analyze and interpret the structure and function of macromolecules and their roles in normal and diseased states.
- Utilize a variety of laboratory techniques and technologies to investigate and manipulate macromolecules.
- Design, analyze and interpret experiments to investigate the role of macromolecules in a variety of biological processes.
- Demonstrate an understanding of the principles of recombinant DNA technology and the potential applications of gene manipulation.
- Explain current research in the field of molecular biology and its implications for biotechnology and biomedicine.
- Communicate effectively in both written and oral formats about molecular biology concepts and research findings.

Course Contents:



- 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
- 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
- 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
- Control of gene expression at transcription and translation level: regulating the expression of phages, viruses, prokaryotic and eukaryotic genes

Reference Books:

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

Course Name: Medical and Diagnostic Technology (Theory)

Course Code: TIU-PMB-T219

Course Objectives:

- Demonstrate an understanding of the principles of medical microbiology and the roles of bacteria, viruses, fungi, and parasites in human health and disease.
- Describe the structure and function of bacterial cells, viruses, fungi, and parasites.
- Identify and discuss the laboratory techniques used to detect and identify microbial organisms.
- Discuss the principles of immunology and the roles of the human immune system in host defense.
- Describe the roles of antimicrobial agents in the prevention, diagnosis, and treatment of infectious diseases.
- Analyze the factors that influence the epidemiology of infectious diseases.
- Discuss the principles of public health and the role of medical microbiology in improving public health.
- Demonstrate the ability to interpret results from microbiological experiments and apply the results to medical and public health situations.



- Utilize appropriate safety procedures in the laboratory and the medical setting.

Course Contents:

- Automation in Microbiology
- Immunoprophylaxis against diseases
- Emerging infectious diseases and detection by modern techniques like ELISA, RIA, Histochemistry, RFLP, RAPD, Mantu, Microarray, PCR etc..
- Bioterrorism.
- Collection of specimens for bacteriological investigations.
- Methods of culture, techniques and organisms encountered in: CSF, blood culture, sputum, pus, urine, stool, UTI, endocarditis, Bone and joint infections.
- Ribotyping.

Reference Books:

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

Course Name: CASD-Scientific writing (Lab)

Course Code: TIU-PMB-S201

Course outcome:

- Develop effective scientific communication skills
- Master the structure and organization of research and review papers
- Convey complex microbiological concepts clearly and concisely
- Acquire proficiency in proper citation methods
- Understand and apply ethical considerations in scientific writing

Course Contents:

- Technical training based on LATEX

Course Name: Cell Biology Lab (Lab)

Course Code: TIU-PMB-L211

Course Contents:

- Microscopic observation of cellular structure.
- Cell culture techniques
- Cell viability test-MTT assay
- Cell permeability and ROS generation by Flow cytometry study
- Fluorescence microscopic study of cell viability by Acridine orange EtBr staining



Course Name: Molecular Biology Lab (Lab)

Course Code: TIU-PMB-L203

Course Contents:

- DNA isolation from bacteria
- Plasmid DNA isolation from bacteria.
- Competent cell preparation
- Transformation
- Restriction digestion
- Agarose gel electrophoresis

Course Name: Medical and Diagnostic technology Lab (Lab)

Course Code: TIU-PMB-L205

Course Contents:

- PCR
- Manual count of white blood cell (WBC's) using a hemocytometer
- Determination of the blood group of an individual
- Techniques of immunoelectrophoresis(SDS PAGE)
- Oucترلony double diffusion technique.
- Precipitation techniques: immunodiffusion
- Immuno-electrophoretic method (Western Blot)

Course Name: Entrepreneurship Skill Development (ESD)

Course Code: TIU-PES-S297

Course Outcome:

- Recognize and evaluate potential business opportunities within microbiology, understanding market needs and trends.Master the structure and organization of research and review papers
- Develop comprehensive business plans and effective strategies for launching and sustaining microbiology-based ventures.
- Understand and apply financial principles for budgeting, projection, and management specific to microbiology startups.
- Navigate legal and ethical considerations associated with entrepreneurship in microbiology, including intellectual property and safety regulations.
- Develop strong communication, networking, and presentation skills to foster innovation, collaboration, and successful business development within the microbiology sector.