



TECHNO INDIA UNIVERSITY
WESTBENGAL

3yr B.Sc (HONOURS)

In

MICROBIOLOGY

SYLLABUS

Choice Based Credit System (CBCS)

2019



Semester Wise Microbiology Honours Courses						
	1	2	3	4	5	6
Core Courses	TIU-HMB-T1C1 TIU-HMB-P1C1 TIU-HMB-T1C3 TIU-HMB-P1C3 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T1C2 TIU-HMB-P1C2 TIU-HMB-T1C4 TIU-HMB-P1C4 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T2C5 TIU-HMB-P2C5 TIU-HMB-T2C7 TIU-HMB-P2C7 TIU-HMB-T2C9 TIU-HMB-P2C9 3T+3P (3X4+3X2=18 Credits)	TIU-HMB-T2C6 TIU-HMB-P2C6 TIU-HMB-T2C8 TIU-HMB-P2C8 TIU-HMB-T2C10 TIU-HMB-P2C10 3T+3P (3X4+3X2=18 Credits)	TIU-HMB-T3C11 TIU-HMB-P3C11 TIU-HMB-T3C13 TIU-HMB-P3C13 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T3C12 TIU-HMB-P3C12 TIU-HMB-T3C14 TIU-HMB-P3C14 2T+2P (2X4+2X2=12 Credits)
Generic Elective Courses	TIU-UCH-T1G1 TIU-UCH-P1G1 1T+1P (1X4+1X2=6 Credits)	TIU-UCH-T1G2 TIU-UCH-P1G2 1T+1P(1X4+1X2=6 Credits)	TIU-UCS-T2G1 TIU-UCS-P2G1 1T+1P (1X4+1X2=6 Credits)	TIU-UCS-T2G2 TIU-UCS-P2G2 1T+1P (1X4+1X2=6 Credits)		
Discipline Specific Elective Courses					TIU-HMB-T3D1 TIU-HMB-P3D1 TIU-HMB-T3D3 TIU-HMB-P3D3 TIU-HMB-T3D5 TIU-HMB-P3D5 2T+2P Any two: (2X4+2X2=12 Credits)	TIU-HMB-T3D2 TIU-HMB-P3D2 TIU-HMB-T3D4 TIU-HMB-P3D4 TIU-HMB-T3D6 TIU-HMB-P3D6 2T+2P Any two: (2X4+2X2=12 Credits)
Skill Enhancement Elective Courses			TIU-HMB-T2S1 TIU-HMB-P2S1 TIU-HMB-T2S3 TIU-HMB-P2S3 1T+0P (1X2=2 Credits)Any one	TIU-HMB-T2S2 TIU-HMB-P2S2 TIU-HMB-T2S4 TIU-HMB-P2S4 1T+0P(1X2=2 Credits)Any one		
CASD	TIU-UCE-T105 1T+0P (2 Credits) (language)	TIU-UES-T106 1T+0P (2 Credits) (Environmental Science)				
Total = 140 Credits	20 Credits	20 Credits	26 Credits	26 Credits	24 Credits	24 Credits





Core Courses		
Semester	Core Courses (Code)	Subject
1	TIU-HMB-T1C1 TIU-HMB-P1C1	Introduction to microbiology and microbial diversity
	TIU-HMB-T1C3 TIU-HMB-P1C3	Bacteriology
2	TIU-HMB-T1C2 TIU-HMB-P1C2	Biochemistry
	TIU-HMB-T1C4 TIU-HMB-P1C4	Cell Biology
3	TIU-HMB-T2C5 TIU-HMB-P2C5	Virology
	TIU-HMB-T2C7 TIU-HMB-P2C7	Microbial physiology and metabolism
	TIU-HMB-T2C9 TIU-HMB-P2C9	Molecular Biology
4	TIU-HMB-T2C6 TIU-HMB-P2C6	Microbial Genetics
	TIU-HMB-T2C8 TIU-HMB-P2C8	Environmental Microbiology
	TIU-HMB-T2C10 TIU-HMB-P2C10	Recombinant DNA Technology
5	TIU-HMB-T3C11 TIU-HMB-P3C11	Food and Dairy Microbiology
	TIU-HMB-T3C13 TIU-HMB-P3C13	Industrial Microbiology
6	TIU-HMB-T3C12 TIU-HMB-P3C13	Immunology
	TIU-HMB-T3C14 TIU-HMB-P3C14	Medical Microbiology





Skill Enhancement Elective Courses		
Semester	Core Courses (Code)	Subject
3	TIU-HMB-T2S1 TIU-HMB-P2S1	Bio fertilizer
	TIU-HMB-T2S3 TIU-HMB-P2S3	Microbial quality control in food and pharmaceutical industry
4	TIU-HMB-T2S2 TIU-HMB-P2S2	Food Fermentation Technique
	TIU-HMB-T2S4 TIU-HMB-P2S4	Microbiological analysis of air and water

Discipline Specific Elective Courses		
Semester	Core Courses (Code)	Subject
5	TIU-HMB-T3D1 TIU-HMB-P3D1	Biostatistics
	TIU-HMB-T3D3 TIU-HMB-P3D3	Medical & Diagnostics Microbiology
	TIU-HMB-T3D5 TIU-HMB-P3D5	Advance Method in Microbiology
6	TIU-HMB-T3D2 TIU-HMB-P3D2	Inheritance Biology
	TIU-HMB-T3D4 TIU-HMB-P3D4	Bioinformatics
	TIU-HMB-T3D6 TIU-HMB-P3D6	Project Work





CORE COURSES

SEMESTER –6

TIU-HMB-T3C12: IMMUNOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS: 4 **Unit 1 Introduction No. of Hours: 4** Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa

Unit 2 Immune Cells and Organs No. of Hours: 7 Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

Unit 3 Antigens No. of Hours: 4 Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants

Unit 4 Antibodies No. of Hours: 6 Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies

Unit 5 Major Histocompatibility Complex No. of Hours: 5 Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways)

Unit 6 Complement System No. of Hours: 4 Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation

Unit 7 Generation of Immune Response No. of Hours: 10 Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells, Introduction to tolerance

Unit 8 Immunological Disorders and Tumor Immunity No. of Hours: 10 Types of Autoimmunity and Hypersensitivity with examples; Immunodeficiencies - Animal models (Nude and





SCID mice), SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency, CGD; Types of tumors, tumor Antigens, causes and therapy for cancers.

Unit 9 Immunological Techniques No. of Hours: 10 Principles of Precipitation, Agglutination, Immunodiffusion, Immuno-electrophoresis, ELISA, ELISPOT, Western blotting, Immunofluorescence, Flow cytometry, Immunoelectron microscopy.

TIU-HMB-P3C12: IMMUNOLOGY (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 21. Identification of human blood groups.

2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum from the blood sample (demonstration).
5. Perform immunodiffusion by Ouchterlony method.
6. Perform DOT ELISA.
7. Perform immunoelectrophoresis.

SUGGESTED READINGS

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology.6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology.6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology.7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology.2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology.6th edition. Wiley Blackwell Publication.

TIU-HMB-T3C14: MEDICAL MICROBIOLOGY(THEORY)





TOTAL HOURS: 60 CREDITS: 4
Unit 1 Normal microflora of the human body and host pathogen interaction

No. of Hours: 8

Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection, Pathophysiologic effects of LPS

Unit 2 Sample collection, transport and diagnosis No. of Hours: 5 Collection, transport and culturing of clinical samples, principles of different diagnostic tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes).

Unit 3 Bacterial diseases No. of Hours: 15 List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control

Respiratory Diseases: *Streptococcus pyogenes*, *Haemophilus influenzae*, *Mycobacterium tuberculosis*
Gastrointestinal Diseases: *Escherichia coli*, *Salmonella typhi*, *Vibrio cholerae*, *Helicobacter pylori*
Others: *Staphylococcus aureus*, *Bacillus anthracis*, *Clostridium tetani*, *Treponema pallidum*, *Clostridium difficile*

Unit 4 Viral diseases No. of Hours: 14 List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, Influenza with brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis

Unit 5 Protozoan diseases No. of Hours: 5 List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control Malaria, Kala-azar

Unit 6 Fungal diseases No. of Hours: 5 Brief description of each of the following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention Cutaneous mycoses: Tinea pedis (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis

Unit 7 Antimicrobial agents: General characteristics and mode of action No. of Hours: 8

Antibacterial agents: Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine Antibiotic resistance, MDR, XDR, MRSA, NDM-1





TIU-HMB-P3C14: MEDICAL MICROBIOLOGY (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2 1. Identify bacteria (any three of *E. coli*, *Salmonella*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests

2. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS

3. Study of bacterial flora of skin by swab method

4. Perform antibacterial sensitivity by Kirby-Bauer method

5. Determination of minimal inhibitory concentration (MIC) of an antibiotic.

6. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chicken pox, HPV warts, AIDS (candidiasis), dermatomycoses (ring worms)

7. Study of various stages of malarial parasite in RBCs using permanent mounts.

SUGGESTED READING

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication

2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier

4. Willey JM, Sherwood LM, and Woolverton CJ.(2013) Prescott, Harley and Klein's Microbiology.9th edition. McGraw Hill Higher Education

5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition.Pearson International Edition.





Discipline Specific Elective Courses

SEMESTER 6

TIU-HMB-T3D2: INHERITANCE BIOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS: 4
Unit 1 Introduction to Genetics Historical developments No. of Hours: 5 Model organisms in genetic analyses and experimentation: *Escherichia coli*, *Saccharomyces cerevisiae*, *Neurospora crassa*, *Caenorhabditis elegans*, *Drosophila melanogaster*, *Arabidopsis thaliana*

Unit 2 Mendelian Principles No. of Hours: 13 Mendel's Laws: Dominance, segregation, independent assortment, deviation from Mendelian inheritance, Rediscovery of Mendel's principles, Chromosome theory of inheritance: Allele, multiple alleles, pseudoallele, complementation tests, Extensions of Mendelian genetics: Allelic interactions, concept of dominance, recessiveness, Incomplete dominance and co-dominance, Multiple alleles, Epistasis, penetrance and expressivity

Unit 3 Linkage and Crossing over No. of Hours: 9 Linkage and recombination of genes, Cytological basis of crossing over, Crossing over at fourstrand stage, Molecular mechanism of crossing over, mapping

Unit 4 Extra-Chromosomal Inheritance No. of Hours: 9 Rules of extra nuclear inheritance, Organelle heredity - Chloroplast mutations in *Chlamydomonas*, mitochondrial, mutations in *Saccharomyces*, Maternal effects - Shell coiling in *Limnaea peregra* Infectious heredity - Kappa particles in *Paramecium*

Unit 5 Characteristics of Chromosomes No. of Hours: 15 Structural organization of chromosomes - centromeres, telomeres and repetitive DNA, Packaging DNA molecules into chromosomes, Concept of euchromatin and heterochromatin, Normal and abnormal karyotypes of human chromosomes, Chromosome banding, Giant chromosomes: Polytene and lampbrush chromosomes, Variations in chromosome structure: Deletion, duplication, inversion and translocation, Variation in chromosomal number and structural abnormalities - Klinefelter syndrome, Turner syndrome, Down syndrome

Unit 6 Recombination No. of Hours: 3 Homologous and non-homologous recombination, including transposition, site-specific recombination.

Unit 7 Human genetics No. of Hours: 3 Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.





Unit 8 Quantitative genetics No. of Hours: 3 Polygenic inheritance, heritability and its measurements, QTL mapping. DSE-6

TIU-HMB-P3D2: INHERITANCE BIOLOGY (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 21. Mendelian deviations in dihybrid crosses

2. Studying Barr Body with the temporary mount of human cheek cells
3. Studying Rhoeo translocation with the help of photographs
4. Karyotyping with the help of photographs
5. Chi-Square Analysis
6. Study of polytene chromosomes using temporary mounts of salivary glands of *Chiromonas* / *Drosophila* larvae
7. Study of pedigree analysis
8. Analysis of a representative quantitative trait

SUGGESTED READING

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
2. Snustad DP, Simmons MJ (2011). Principles of Genetics. 6th Ed. John Wiley and Sons Inc.
3. Weaver RF, Hedrick PW (1997). Genetics. 3rd Ed. McGraw-Hill Education
4. Klug WS, Cummings MR, Spencer CA, Palladino M (2012). Concepts of Genetics. 10th Ed. Benjamin Cummings
5. Griffith AJF, Wessler SR, Lewontin RC, Carroll SB. (2007). Introduction to Genetic Analysis. 9th Ed. W.H. Freeman and Co., New York
6. Hartl DL, Jones EW (2009). Genetics: Analysis of Genes and Genomes. 7th Ed, Jones and Bartlett Publishers
7. Russell PJ. (2009). i Genetics - A Molecular Approach. 3rd Ed, Benjamin Cummings





TIU-HMB-T3D4: BIOINFORMATICS (THEORY)

TOTAL HOURS: 60 CREDITS: 4 Unit 1 Introduction to Computer Fundamentals No. of Hours: 8

RDBMS - Definition of relational database Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer

Unit 2 Introduction to Bioinformatics and Biological Databases No. of Hours: 14
Biological databases - nucleic acid, genome, protein sequence and structure, gene expression databases, Database of metabolic pathways, Mode of data storage - File formats - FASTA, Genbank and Uniprot, Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB

Unit 3 Sequence Alignments, Phylogeny and Phylogenetic trees No. of Hours: 16 Local and Global Sequence alignment, pairwise and multiple sequence alignment. Scoring an alignment, scoring matrices, PAM & BLOSUM series of matrices Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA, Neighbour joining, Maximum Parsimony, Maximum likelihood

Unit 4 Genome organization and analysis No. of Hours: 10 Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes Genome, transcriptome, proteome, 2-D gel electrophoresis, MaldiToff spectroscopy Major features of completed genomes: E.coli, S.cerevisiae, Arabidopsis, Human

Unit 5 Protein Structure Predictions No. of Hours: 12 Hierarchy of protein structure - primary, secondary and tertiary structures, modeling Structural Classes, Motifs, Folds and Domains Protein structure prediction in presence and absence of structure template Energy minimizations and evaluation by Ramachandran plot Protein structure and rational drug design

TIU-HMB-P3D4: BIOINFORMATICS (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2 1. Introduction to different operating systems - UNIX, LINUX and Windows

2. Introduction to bioinformatics databases (any three): NCBI/PDB/DDBJ, Uniprot, PDB

3. Sequence retrieval using BLAST

4. Sequence alignment & phylogenetic analysis using clustalW&phylip





5. Picking out a given gene from genomes using Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool
6. Protein structure prediction: primary structure analysis, secondary structure prediction using psipred, homology modeling using Swissmodel. Molecular visualization using jmol, Protein structure model evaluation (PROCHECK)
7. Prediction of different features of a functional gene

SUGGESTED READING

1. Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House
2. Pradeep and SinhaPreeti (2007) Foundations of Computing, 4th ed., BPB Publications
3. Lesk M.A.(2008) Introduction to Bioinformatics . Oxford Publication, 3rd International Student Edition
4. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
5. Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell

TIU-HMB-T32D6: PROJECT WORK

