TECHNO INDIA UNIVERSITY
WESTBENGAL

Syllabus for 3-year B.Sc (Honours)in Microbiology

2018

Choice Based Credit System (CBCS)

Department of Microbiology

Techno India University, West Bengal

EM-4, EM Block, Sector V, Bidhannagar, Kolkata, West Bengal 700091

TECHNO INDIA UNIVERSITY
WESTBENGAL

B.Sc Microbiology (CBCS)

Course Curriculum for All Semester

Semester VI

Sl. No.	Course Code	Course Title	Contact Hrs. / Week			Credit	Page No.
			L	T	P		
Theory							
1	TIU-HMB-T302	IMMUNOLOGY	03	01	00	04	
2	TIU-HMB-T304	MEDICAL MICROBILOGY	03	01	00	04	
3	TIU-DSE-T306	PROJECT WORK*	00	00	06	06	
4	TIU-DSE-T302/ TIU-DSE-T304	Inheritance Biology/ Bioinformatics*	03	01	00	04	
Practical							
1	TIU-HMB-L302	IMMUNOLOGY	00	00	02	02	
2	TIU-HMB-L304	MEDICAL MICROBILOGY	00	00	02	02	
3	TIU-DSE-L302/ TIU-DSE-L304	Inheritance Biology/ Bioinformatics	00	00	02	02	
Total Credit						24	

*Any two from the above three subjects

CORE COURSES

SEMESTER –6

TIU-HMB-T302: IMMUNOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Course Outcome:

After successful completion, this course enables students:

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

Contents:

Unit 1 Introduction No. of Hours: 4Concept 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: 6Structure, 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 andSCID 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, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluoresence, Flow cytometry, Immunoelectron microscopy.

TIU-HMB-L302: IMMUNOLOGY (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2

1. 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'sImmunobiology.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-T304: MEDICAL MICROBILOGY(THEORY)

TOTAL HOURS: 60 CREDITS: 4

Course Outcome:

After successful completion, this course enables students:

- To understand the normal microflora of different parts of the human body.
- To have knowledge on different cell culture media and their preparation methods.
- To gain knowledge on various bacterial and viral diseases .
- To understand the different protozoan and fungal diseases and their causative agents.
- To get an insight into the various antimicrobial, antifungal agents and their mode of action.

Contents:

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 controlRespiratory Diseases: Streptococcus pyogenes, Haemophilusinfluenzae, Mycobacterium tuberculosis Gastrointestinal Diseases: Escherichia coli,Salmonella typhi, Vibrio cholerae, Helicobacter pyloriOthers: Staphylococcus aureus, Bacillus anthracis, Clostridium tetani, Treponemapallidum, Clostridium difficie

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: Tineapedis (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-L304: 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.

SEMESTER 6

TIU-DSE-T302: INHERITANCE BIOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Course Outcome:

After successful completion, this course enables students:

- To understand the Mendelian Principles and its deviation.
- To acquire knowledge about allele, linkage and epistasis..
- To understand the molecular Basis of crossing over.
- To gain knowledge about some disease due to change in chromosome number.
- To understand about pedigree analysis.

Contents:

Unit 1 Introduction to Genetics Historical developments No. of Hours: 5 Model organisms in genetic analyses and experimentation: Escherichia coli, Saccharomyces cerevisiae, Neurosporacrassa, Caenorhabditiselegans Drosophila melanogaster, Arabidopsis thaliana

Unit 2 Mendelian Principles No. of Hours: 13Mendel'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 Limnaeaperegra 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: 3Homologous 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-DSE-L 302 : INHERITANCE BIOLOGY (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2

1. 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-DSE-T304: BIOINFORMATICS (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Course Outcome:

After successful completion, this course enables students:

- Understanding and remembering about biological databases and its application in various sectors.
- Remembering, understanding and creating sequence alignment by applying appropriate algorithms.
- Creating phylogenetic trees by applying and evaluating suitable methods.
- Analyze, apply, and create protein structure and perform drug designing.
- Understanding and remembering about biological databases and its application in various sectors.

Contents:

Unit 1 Introduction to Computer FundamentalsNo. 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 ofmetabolic 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 Parsomony, 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-DSE-L304: 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 psi-pred, 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-DSE-P306: PROJECT WORK(6 CREDITS)