



Bhavan's Vivekananda College

of Science, Humanities & Commerce

Sainikpuri, Secunderabad
Autonomous College - Affiliated to Osmania University
Re-accredited with 'A' grade by NAAC
Syllabus - B Sc I Year Biotechnology
(w.e.f academic year: 2026-27)

Semester I

Course: Cell Biology, Genetics and Biostatistics

Hour/week: 4

Course Code: BT133 (60 Hours)

Credits: 4

Course Objectives: The objectives of this course are,

1. To apply the knowledge of Cell biology, Genetics and Biostatistics.
2. To inculcate critical thinking and problem solving skills using principles of Genetics.
3. To understand intracellular organization of prokaryotic & eukaryotic cells & its morphology.
4. To comprehend the molecular processes of cell cycle, cell division and cell death.
5. To interpret the mechanisms of inheritance and variation.
6. To apply the basic concepts of Biostatistics and its significance.

Unit I: Cell Structure and Functions

(15 hours)

- 1.1 Cell as basic unit of living organisms - bacterial, fungal, plant and animal cells (2)
- 1.2 Ultrastructure of Prokaryotic cell: Cell wall, Cell membrane, Nucleoid, Plasmids (2)
- 1.3 Ultrastructure of Eukaryotic cell: Cell wall, Cell membrane, Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi apparatus, Ribosomes, Lysosomes, Peroxisomes, Glyoxysomes (4)
- 1.4 Cell membrane - Fluid mosaic model, Sandwich model, Cell membrane permeability, Transport across membrane - active & passive transport, Cytoskeleton - microtubules & microfilaments (3)
- 1.5 Structure of Chromosome - chromatids, centromere, telomere, Components of chromosomes - histones & non histones (2)
- 1.6 Specialized chromosomes - Polytene & Lampbrush chromosomes (2)

Unit II: Cell Division and Cell Cycle

(15 hours)

- 2.1 Bacterial cell division (2)
- 2.2 Phases of Eukaryotic Cell cycle (2)

B. Chakraborty
8/4/26

DR. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University
Hyderabad-500007

Dr. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University,
Hyderabad-500007.

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College,
Sainikpuri

- 2.3 Mitosis-Stages (Spindle assembly) & significance (3)
 2.4 Meiosis-Stages (Synaptonemal complex) & significance (3)
 2.5 Regulations of Cell cycle – proteins involved in check points (2)
 2.6 Senescence, Necrosis and Apoptosis (3)

(15 hours)

Unit III: Principles and Mechanism of Inheritance

- 3.1 Mendel's experiments on Pea plants, Mendel's Laws - Law of Dominance, Law of Segregation - Monohybrid Ratio, Law of Independent Assortment - Dihybrid ratio (3)
 3.2 Deviation from Mendel's Laws - Partial or Incomplete dominance (Eg. Flower Colour in *Mirabilis jalapa*), Co-dominance (Eg. MN Blood groups), Non-Mendelian inheritance (Variegation in leaves of *Mirabilis jalapa*) (3)
 3.3 Non allelic interactions – types of Epistasis (2)
 3.4 Penetrance and Expressivity (Eg. Polydactyly, Waardenburg syndrome), Pleiotropism (Sickle Cell Anemia), Multiple allelism (Eg. ABO Blood groups) (2)
 3.5 X-Y chromosomes - Sex determination in *Drosophila*, Birds, Man, *Bonelia*; Sex-linked inheritance – X- linked recessive inheritance (Hemophilia, Colour blindness), Y-linked inheritance - Holandric genes
 (2)
 3.6 Linkage and Recombination – Cytological proof of crossing over (Eg: *Drosophila*) and phases of linkage, recombination frequency (two point, three point test cross) (3)

(15 hours)

Unit IV: Biostatistics - Basic Concepts

- 4.1 Introduction to Biostatistics; Kinds of data & variables, sample size, methods of sampling - random & non-random (2)
 4.2 Measures of central tendency - mean, median, mode (2)
 4.3 Measures of dispersion - range, mean deviation, variance and standard deviation, standard error (2)
 4.4 Diagrammatic (line diagram, bar diagram & pie diagram) and graphical representation of data (histogram, frequency polygon & frequency curve) (3)
 4.5 Concepts of probability – probability rules, probability distribution: Binomial & Poisson distributions and Normal distribution (3)
 4.6 Hypothesis testing – null and alternative hypothesis; Test of Significance (Student's t-test and Z-test). Chi-square (test of goodness of fit, contingency) & its significance (3)

Course Outcomes: By the end of the course, the students will be able to,

- BT133.CO1:** To analyze the fundamental concepts of Cell biology, Genetics, and Biostatistics.
BT133.CO2: To demonstrate critical thinking and problem-solving skills in interpreting biological data and processes.
BT133.CO3: To describe and differentiate the intracellular organization and structural features of prokaryotic and eukaryotic cells.

B. Chandra
 8/4/20
 CHAIRPERSON
 BOS in Genetics/Biotechnology
 Bhavan's Vivekananda College
 Sainikpuri

DR. S. PRASHANT
 Associate Professor
 (Biotechnology)
 Department of Genetics
 Osmania University
 Hyderabad-500007

Dr. S. PRASHANT
 Associate Professor
 (Biotechnology)
 Department of Genetics
 Osmania University,
 Hyderabad-500007.

BT133.CO4: To interpret the molecular mechanisms of the cell cycle, cell division (mitosis and meiosis), and programmed cell death.

BT133.CO5: To analyze patterns of inheritance and sources of genetic variation using established genetic principles.

BT133.CO6: To apply basic biostatistical methods to organize, analyze, and interpret biological data.

Course: Cell Biology, Genetics and Biostatistics -Practicals

Hour/week: 2

Course Code: BT133P (30 Hours)

Credits: 1

Course Objectives: The objectives of this course are,

1: To build practical skills in Cell Biology, Genetics and Biostatistics through hands-on experiments.

2: To train students in solving problems in Genetics and Biostatistics

Practicals

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (pollen mother cells in plants)
4. Monohybrid and Dihybrid ratio in Drosophila/Maize
5. Problems on Co-dominance
6. Problems on Epistasis
7. Problems on Mean, Median and Mode
8. Construction of bar diagram, pie diagram, line diagram, histogram
9. Problems on probability & probability distribution
10. Problems on Hypothesis testing – Student's t-test, Z-test, Chi-square test

B. Sainikpur
8/4/20

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpur

Dr. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University,
Hyderabad-500007.

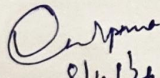
Course Outcomes: By the end of the course, the students will be able to,

BT133P.CO1: To distinguish the basic processes of Cell Division.

BT133P.CO2: To evaluate the microscopic handling techniques and develop analytical skills for problem-solving in Genetics and Biostatistics.

Reference books

1. Cell & Molecular Biology by E.D.O.Robertis & E.M.F De Robertis, Waverly
2. The cell: A Molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press
3. Cell Biology and Genetics by P. K. Gupta.
4. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill
5. An introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication
6. Biometry by: Sokal and Rohlf W.H. Freeman
7. Biostatistics by: N.T.J. Bailey
8. Fundamentals of Biostatistics: Khan and Khanum. Ukaaz publications, India
9. Biostatistics; Jayasree Publishers by: Vishweswara Rao K

B. 
CHAITYA
8/4/20
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri


Dr. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University,
Hyderabad-500007.

DR. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University

 Bhavan
Bhavan's Vivekananda College
of Science, Humanities & Commerce
Sainikpuri, Secunderabad
Autonomous College - Affiliated to Osmania University
Re-accredited with 'A' grade by NAAC
Syllabus - B Sc I Year Biotechnology
(w.e.f academic year: 2026-27)

Semester II

Course: Microbiology and Immunology

Hour/week: 4

Course Code: BT233 (60 Hours)

Credits: 4

Course Objectives: The objectives of this course are,

1. To impart the knowledge of Microbiology and Immunology.
2. To inculcate skills of critical thinking in Microbiology and Immunology.
3. To understand the general characteristics of microorganisms.
4. To culture different bacteria and know how to preserve them.
5. To understand an overview of different types of immunity, cells & organs involved in the immune system.
6. To apply the knowledge of immunoglobulins in immune disorders.

Unit I: Fundamentals of Microbiology

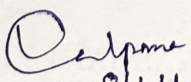
(15 hours)

- 1.1 Historical development of Microbiology and Contributors of Microbiology (2)
- 1.2 Basic Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy (2)
- 1.3 Advanced Microscopy: Fluorescent microscopy, Scanning and Transmission Electron microscopy (3)
- 1.4. Introduction to Microorganisms (Archaea, Bacteria, Algae, Fungi, Mycoplasma and Viruses) (3)
- 1.5 General characteristics of bacteria and virus, disease-causing pathogens and symptoms (*Mycobacterium tuberculosis*, Hepatitis B) (3)
- 1.6. General characteristics and applications of micro-algae and fungi (2)

Unit II: Culture and Identification of Microorganisms

(15 hours)

- 2.1. Methods of sterilization - physical and chemical methods (2)

B. 
8/4/24
CHAIRPERSON
BOS in Genetics
Bhavan's Vivekananda College
Sainikpuri


Dr. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University,
Hyderabad-500007.

- 2.2. Bacterial nutrition - nutritional types of bacteria, essential macro, micronutrients and growth factors (2)
- 2.3. Bacterial growth curve - batch and continuous cultures, synchronous cultures, measurement of bacterial growth-measurement of cell number and cell mass (4)
- 2.4. Factors affecting bacterial growth (2)
- 2.5. Culturing of anaerobic bacteria and viruses (3)
- 2.6. Pure culture and its characteristics (2)

Unit III: Basics of Immunology

(15 hours)

- 3.1 Types of Immunity - innate and adaptive Immunity (3)
- 3.2 Cells of the immune system: T-cells (helper and cytotoxic cells), B-cells, Natural killer cells, Macrophages, Basophils and Dendritic cells (3)
- 3.3 Primary organs of immune system - Thymus and Bone marrow (2)
- 3.4 Secondary organs of immune system - Spleen and Lymph nodes (2)
- 3.5 Antigens-immunogenicity vs antigenicity, factors affecting antigenicity, Epitopes (3)
- 3.6 Haptens & types of adjuvants (2)

Unit IV: Humoral and Cell Mediated Immunity

(15 hours)

- 4.1 Structure of immunoglobulin - types and functions of immunoglobulins (3)
- 4.2 Major Histocompatibility Complex (MHC) & Human Leukocyte Antigen (HLA)-role in organ transplantation (3)
- 4.3 Cell mediated immunity- T-cell receptor (TCR), Antigen Presenting Cells (APCs), ternary complex (TCR, peptide & MHC); cytokines (3)
- 4.4 Hypersensitivity- types I, II, III & IV (2)
- 4.5 Autoimmunity- Mechanisms of autoimmunity; Autoimmune diseases - Systemic lupus erythematosus, Rheumatoid arthritis (2)
- 4.6 Monoclonal antibody (MAbs) production and its applications, Vaccines (2)

Course Outcomes: By the end of the course, the students will be able to,

BT233.CO1: To interpret the knowledge of Microbiology and Immunology.

BT233.CO2: To demonstrate critical thinking skills in analyzing infections and immunological disorders.

BT233.CO3: To understand the basics of microbiology and microbial classification.

BT233.CO4: To illustrate culturing of different types of bacteria and their preservation.

BT233.CO5: To analyze the antigen-antibody interactions and their relevance in immunology.

BT233.CO6: To apply the knowledge and skills to understand immunoassays effectively in various scientific and biomedical sciences.

B. Calpura
8/4/20
CHANDRASEKHAR
BOCHERED TO INSTITUTE
BHAVAR
Sainikpuri

Dr. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University,
Hyderabad-500007.

Course: Microbiology and Immunology -Practicals

Hour/week: 2

Course Code: BT233P (30 Hours)

Credits: 1

Course Objectives: The objectives of this course are,

- 1:** To build practical skills in Microbiology and Immunology through hands-on experiments.
- 2:** To train students in Microbiology and Immunology techniques.

Practicals

1. Sterilization methods – Autoclave, Hot Air Oven, Filtration
2. Preparation of microbiological media (bacterial, algal & fungal)
3. Isolation of bacteria by streak, spread and pour plate methods
4. Isolation of bacteria from soil
5. Simple staining and differential staining (Gram's staining)
6. Bacterial growth curve
7. Blood grouping
8. Single radial immunodiffusion
9. ELISA
10. Viability test of cells/bacteria (Evans blue test or tryphan blue test)

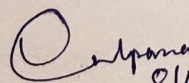
Course Outcomes: By the end of the course, the students will be able to,

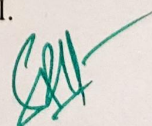
BT233P.CO1: To evaluate the microscopic handling, sterilization and staining techniques.

BT233P.CO2: To demonstrate the immunological skills and techniques.

Reference books

1. Biology of Microorganisms by: Brock, T.D. and Madigan, M.T.
2. Microbiology by: Prescott, L.M., Harley, J.P. Klein, D.A.
3. Microbiology by: Pelczar, M.J, Chan, E.C.S., Ereig, N.R.
4. Microbiological applications by: Benson
5. Essential Immunology. Publ: Blackwell by: Roitt I.

B. 
8/4/24
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College



Dr. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University,
Hyderabad-500007.

6. Immunology. Publ: Blackwell by: Reeve G. & Todd I.
7. Cellular and Molecular Immunology. Saunders Publication, Philadelphia by: Abbas
A.K. Lichtman A.H., Pillai S.
8. Kuby's Immunology. W.H. Freeman and Company by: Golds R.A., Kindt T.J., Osborne

B. *Chakraborty*
8/4/22
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

CS
Dr. S. PRASHANT
Associate Professor
(Biotechnology)
Department of Genetics
Osmania University
Hyderabad-500007.