Mahatma Gandhi University

B.Sc – Biotechnology (with effective from Academic Year 2025-26)

Code	Course Title	Course Type	HPW	Credits
FIRST YEAR SEMESTER I				
BS101	**Major - I Cell Biology, Genetics & Biostatistics**	DSC1A	4T+2P=6	4+1=5
BS102	Major – II	DSC2A	4T+2P=6	4+1=5
BS103	Minor	DSC3A	4T+2P=6	4+1=5
BS104	English	AEC1A	5	5
BS105	Second Language	AEC2A	5	5
	Total		**28**	**25**
FIRST YEAR SEMESTER II				
BS201	**Major - I Microbiology & Immunology**	DSC1B	4T+2P=6	4+1=5
BS202	Major – II	DSC2B	4T+2P=6	4+1=5
BS203	Minor	DSC3B	4T+2P=6	4+1=5
BS204	English	AEC1B	5	5
BS205	Second Language	AEC2B	5	5
	Total		**28**	**25**
SECOND YEAR SEMESTER III				
BS301	**Major - I Biological Chemistry & Molecular Biology**	DSC1C	4T+2P=6	4+1=5
BS302	Major – II	DSC2C	4T+2P=6	4+1=5
BS303	Minor	DSC3C	4T+2P=6	4+1=5
BS304	English	AEC1C	5	5
BS305	Second Language	AEC2C	5	5
	Total		28	**25**
SECOND YEAR SEMESTER IV				
BS401	**Major - I Recombinant DNA Technology & Bioinformatics**	DSC1D	4T+2P=6	4+1=5
BS402	Major – II	DSC2D	4T+2P=6	4+1=5
BS403	Minor	DSC3D	4T+2P=6	4+1=5
BS404	English	AEC1D	5	5
BS405	Second Language	AEC2D	5	5
	Total		28	**25**

Dr. K. Premsagar
Chairman
Board of Studeies in Biotechnology
Mahatma Gandhi University,
Nalgonda.

Code	Course Title	Course Type	HPW	Credits
	THIRD YEAR SEMESTER V			
BS501	**Major – I Plant & Animal Biotechnology**	DSC1E	4T+2P=6	4+1=5
BS502	**Major - II**	DSC2E	4T+2P=6	4+1=5
BS503	**Basics in Biotechnology**	MDC	4	4
BS504	Skill Enhancement Course - I	SEC1	2	2
BS505	Skill Enhancement Course - II	SEC2	2	2
BS506	Value Added Course - I	VAC1	3	3
	Total		**23**	**21**
	THIRD YEAR SEMESTER VI			
BS601	**Elective:** **Optional - I** **(A) Industrial & Environmental Biotechnology/** **(B) Medical Biotechnology**	DSC1F	4+2=6	4+1=5
BS602	**Major – II A/B**	DSC2F	4+2=6	4+1=5
BS603	Skill Enhancement Course - III	SEC3	2	2
BS604	**Skill Enhancement Course – IV** **Biophysical and Molecular Techniques/ Bioprocessing Technology/ Food Biotechnology/ Intellectual Property Rights, Good Laboratory Practices & Good Manufacturing Practices**	**SEC4**	2	2
BS605	Value Added Course - II	VAC2	3	3
BS606	Internship/Project Work		4	4
	Total		**23**	**21**
	Grand Total			**142**

Credits under Non-CGPA
(Community Engagement & Service)

Major - I	30
Major - II	30
Minor	20
AEC (Ability Enhancement Course) - English	20
Second Language – Telugu/Hindi/Urdu etc.	20
MDC (Multi Disciplinary Course)	4
SEC (Skill Enhancement Course)	8
VAC (Value Added Course)	6
Internship/ Project Work	4
Total	**142**

1	NSS/NCC/Sports/Extra curricular	Upto 3 Credits (2 in each year)
2	IKS	Upto 4 Credits (2 in each, after I & II years)

Value Added Courses:
Paper I: Environmental Science (EVS)/Cyber Security & Cyber Laws
Paper II: Cyber Security & Cyber Laws/ Environmental Science (EVS)/ Introduction to Indian Constitution/

Health & Wellness

Skill Enhancement Courses:

Paper I: Communication Skills/ Professional Development Skills/ Entrepreneurship & Startups

Paper II: Professional Development Skills/ Communication Skills/ Entrepreneurship & Startups

Paper III: Fundamentals of AI Tools/ Ability Skills (Competitive Mathematics)

Paper IV: Biophysical and Molecular Techniques/ Fermentation Technology/ Food Biotechnology

B.Sc BIOTECHNOLOGY I YEAR
SEMESTER- I
Major - I (DSC-1A)
BS 101: CELL BIOLOGY, GENETICS AND BIOSTATISTICS

Course Objectives

A. To understand intracellular organization of prokaryotic & eukaryotic cells & its morphology.
B. To comprehend the molecular process of cell cycle, cell division and cell death.
C. To understand the mechanism of inheritance and variation
D. To comprehend the basic concepts of biostatistics and significance

Course Outcomes

A. Knowledge on cytological architectural of prokaryotic & eukaryotic cell
B. Attain Knowledge on the basic mechanism underlying in cell cycle, cell division and cell death
C. Acquire the knowledge of traits inheritance from one generation to another
D. Gain knowledge of sampling and measures of central tendency, probability and Hypothesis
testing

Unit I: Cell Structure and Functions

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

Unit II: Cell Division and Cell Cycle

2.1. Bacterial cell division
2.2. Phases of Eukaryotic Cell cycle
2.3. Mitosis - Stages (Spindle assembly) & significance
2.4. Meiosis - Stages (Synaptonemal complex) & significance
2.5. Regulations of Cell cycle – proteins involved in check points
2.6. Senescence, Necrosis and Apoptosis

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

3.2 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 Non allelic interactions – types of Epistasis,

3.4 Penetrance and Expressivity (Eg. Polydactyly, Waardenburg syndrome), Pleiotropism, Multiple allelism (Eg: ABO Blood groups)

3.5 X-Y chromosomes - Sex determination in Drosophila, Birds, Man, *Bonellia;* Sex-linked inheritance – X- linked Inheritance (Hemophilia, Colour blindness),Y- linked inheritance - Holandric genes

3.6 Linkage and Recombination – Cytological proof of crossing over (Ex: Drosophila) and phases of linkage, recombination frequency

Unit IV: Biostatistics-Basic Concepts

4.1 Introduction to Biostatistics; Kinds of data & variables, sample size, methods of sampling - random & non-random,

4.2 Diagrammatic (line diagram, bar diagram & pie diagram) and graphical representation of data (histogram, frequency polygon & frequency curve)

4.3 Measures of central tendency - mean, median, mode;

4.4 Measures of dispersion - range, mean deviation, variance and standard deviation, standard error,

4.5 Concepts of probability –, probability rules, Probability distribution: Binomial & Poison distributions and Normal distribution

4.6 Hypothesis testing – null and alternative hypothesis; Test of Significance (Student's t – test and Z-test). Chi-square test & its significance;

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

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: VishweswaraRao K

B.Sc BIOTECHNOLOGY I YEAR
SEMESTER - II
Major- I (DSC-1B)
BS 201: MICROBIOLOGY & IMMUNOLOGY

1. Course Objectives (C. Obj):

A. To learn the general characteristics of microorganisms
B. To gain knowledge of the sterilization methods and bacterial growth
C. To understand an overview of different types of immunity, cells & organs involved in the immune system.
D. To comprehend the immunoglobulins and autoimmune disorders

2. Course Outcomes (C.O):

A. Understanding the basics of microbiology and microbial classification
B. To culture different bacteria and know how to preserve them
C. Remember, interpret, and use the basic concepts to have a comprehensive understanding of antigen-antibody interactions and their relevance in immunology
D. Define, summarize, use, and analyse the knowledge, skills, and competencies to understand immunoassays effectively in various scientific and biomedical sciences

Unit I: Fundamentals of Microbiology

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

Unit II: Culture and Identification of Microorganisms

2.1. Methods of sterilization - physical and chemical methods
2.2. Bacterial nutrition - nutritional types of bacteria, essential macro, micronutrients and growth factors.
2.3. Bacterial growth curve - batch and continuous cultures, synchronous cultures, measurement of bacterial growth-measurement of cell number and cell mass
2.4. Factors affecting bacterial growth
2.5. Culturing of anaerobic bacteria and viruses
2.6. Pure culture and its characteristics

Unit III: Basics of Immunology

3.1 Types of Immunity - innate and adaptive Immunity
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 Primary organs of immune system - Thymus and Bone marrow
3.4 Secondary organs of immune system - Spleen and Lymph nodes
3.5 Antigens-immunogenicity vs antigenicity, factors affecting antigenicity, Epitopes,
3.6 Haptens & types of adjuvants

Unit IV: Humoral and Cell Mediated Immunity

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

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)

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.
6. Immunology. Publ: Blackwell by: Reever 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