

VANITA VISHRAM WOMEN'S UNIVERSITY
SCHOOL OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY



BACHELOR OF SCIENCE (B.Sc.) IN BIOTECHNOLOGY
For Undergraduate (UG) Education

SEMESTER - 4
Core Course (CC)

**Syllabus applicable to the students seeking admission in the
following Program**

B.Sc. Biotechnology w.e.f. the Academic Year 2023-24

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 4

CORE COURSE PAPER

GENERAL GENETICS

Course Objectives:

- To instill the basic concepts of science of heredity to students, to aware them with how genetic traits, genotype and phenotype are transferred from their parents to offsprings and their pattern. Role of genes in traits improvement via breeding techniques etc.

Course Outcome:

- To give information and knowledge about basic components of Genetics.
- To make students aware about principle of inheritance and its characteristics.
- To explain the students about various Mendelian principles.
- To make students understand about genetic linkage and inheritance.
- To learn them to basic fundamentals of sex determination and linked genes and progeny improvement.

BT11390 - THEORY COURSE CONTENT

(2 Credits)

Unit I	Introduction: <ul style="list-style-type: none">• Historical developments in the field of genetics.• Growth of a science: from Mendel to genetic engineering• Mendelian genetics.• Mendel's Study of heredity; Applications of Mendel's Principles.• Allelic and non- allelic interactions: Gene Action: From Genotype to Phenotype.	8
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Unit II	Chromosome and genomic organization: <ul style="list-style-type: none"> • Structure and characteristics of bacterial and eukaryotic chromosome. • Eukaryotic nuclear genome composition. • Coding and Noncoding DNA • Genetic organization of prokaryotic and viral genome 	7
Unit III	Sex determination and Sex linkage <ul style="list-style-type: none"> • Sex Chromosomes and Sex Determination • Sex-Linked Genes in Humans. • Variations in chromosome number and structure. • Polyploidy and Aneuploidy 	7
Unit IV	Linkage, crossing over and population genetics <ul style="list-style-type: none"> • Genetic linkage, recombination and crossing over. • Cytoplasmic inheritance: Organelle heredity. • Population genetics: Genetic variation, Hardy Weinberg law. 	8

SUGGESTED READING

- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.
- Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
- Cell and Molecular Biology: A Lab Manual. K.V. Chaitanya, PHI Learning Private Ltd

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 4

CORE COURSE PAPER

IMMUNOLOGY-I

Course Objectives:

- The main objective is in understanding immune-molecules for defense mechanism
- Demonstrate knowledge and understanding the principles that govern adaptive immunity
- To spread awareness regarding various immunoassays and their application in the field of biotechnology
- To give Students a brief study on hypersensitivity and complement system.

Course Outcome:

- Students will be very much clear regarding the immune molecules that fight to protect an individual
- The application of various immunological assays can bring awareness among students and they can apply in their future career.
- An enriched information regarding progress made by biotechnology in immune-technology will make each student more productive

BT11400 - THEORY COURSE CONTENT

(2 Credits)

UNIT 1	Introduction, Types of Immunity (Innate, Adaptive & Herd), Innate (non-specific) Immunity: First Line of defense (Physical, Chemical & Biological); Anatomic, Physiological, Phagocytic & Inflammatory barriers; Second Line of defense (Humoral, Inflammation & Phagocytosis), Adaptive (specific) Immunity: Cellular Immunity, Generation & Functions of	7 lectures
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	Humoral Immunity.	
UNIT 2	Hematopoiesis Cells of the immune system and their function Primary and Secondary organs of immune system.	8 lectures
UNIT 3	Antigen & Antibody: Antigen: Characteristics & types, Antibody: Basis Structure, types and Functions; Monoclonal & polyclonal antibodies	8 Lectures
UNIT 4	Antigen-antibody Interactions: Types & Principles of antigen-antibody reactions (Affinity, Avidity & Cross reactivity), Visualization of antigen-antibody complexes: Precipitation reactions, Agglutination reactions, Types of immunodiffusions, ELISA, RIA, Immunofluorescence techniques.	7 Lectures

SUGGESTED READING

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. Immunology. 7th -12th edition. W. H. 2003.
2. Roitt, LM. Essentials of Immunology, Willey and Black Well Scientific. 13th Edition. 2017.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. Prescott, Harley, and Klein's microbiology. 7 th -12th edition. New York: McGraw-Hill Higher Education 2008.
4. Abbas, A.K. Lichtman, A.M. and Pober, J.S. Cellular and Molecular immunology 3rd edition Philadelphia: W.B. Saunders. 1997.
5. Ashim Chakravarty, Immunology And Immunotechnology- Oxford University Press, ISBN-13: 978-0-19-567688-4

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 4

CORE COURSE PAPER

FERMENTATION TECHNOLOGY I

Course Objectives:

- The course is planned so students would be able to understand the basic principle of fermentation technique
- Students will be aware regarding different medias used in fermentation technology
- The in-depth knowledge regarding upstream and downstream processing
- Students would be given knowledge of fermenters and its mechanism

Course Outcome:

- Upon completion of the course, the student shall be able to comprehend
- Student would be clear regarding the basic principle of fermentation technology
- They would be known regarding the microorganisms used in Fermentation technology and its applicative part
- This course will enhance their interest in various fermentation industries were they can built up their career

BT11410 - THEORY COURSE CONTENT

(2 Credits)

UNIT 1	Introduction to fermentation: <ul style="list-style-type: none">• History and chronological development of fermentation Technology, Principle components of fermentation technology, Primary and secondary metabolites Isolation and screening of industrial microorganisms: <ul style="list-style-type: none">• Isolation and screening of microorganisms, Improvement of strains producing primary and secondary metabolites, Preservation of Industrially	7 lectures
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	important microorganisms	
UNIT 2	Media for Industrial Fermentations: <ul style="list-style-type: none"> Nitrogen source, Minerals, Growth factors, Nutrient recycle, Buffers, Precursors and metabolic regulators, oxygen, antifoams, Media Optimization, Animal cell fermentation media 	8 lectures
UNIT 3	Design of Fermenter <ul style="list-style-type: none"> Basic function of fermenter, Body construction material (Aeration & agitation, Achievement and maintenance of aseptic conditions, Valves and steam traps), Types of fermentation vessels (Air-lift, Bubble column/tower fermenter, deep-jet, packed towers, bio filters and other fixed film processes, solid state fermenter, membrane fermenters) 	
UNIT 4	Industrial Sterilization <ul style="list-style-type: none"> Principles of sterilization, Sterilization of equipment, Sterilization of production media, Sterilization of air 	
SUGGESTED READING		
<ol style="list-style-type: none"> Casida LE. Industrial Microbiology. 1st edition. Wiley Eastern Limited 1991. Crueger W and Crueger A. Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi . 2000. Patel AH. Industrial Microbiology. 1st edition, Macmillan India Limited. 1996. Stanbury PF, Whitaker A and Hall SJ. Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd. 2006. 		

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY

SEMESTER 4

CORE COURSE PAPER

BIOTECHNOLOGY PRACTICAL IV

BT11420 - PRACTICAL COURSE CONTENT

(3 Credits)

1.	Permanent and temporary mount of mitosis.
2.	Karyotyping with the help of photograph.
3.	Drawing Punnett square to calculate ratio of genotype and phenotype
4.	Monohybrid cross, genotypic and phenotypic ratio and its Modification.
5.	Study of Dihybrid cross and find genotypic and phenotypic ratio.
6.	Detect the concentration of antigen by radial immunodiffusion assay method
7.	Detection of antigen/antibody by Latex agglutination assay
8.	Dot ELISA assay for detection of antigen/antibody
9.	Understand Reverse/forwards strands and reverse complementary strand
10.	Access to Databases/ database searches
11.	Using BLAST to identify a gene
12.	Multiple Sequence Alignment (MSA)
13.	Bacterial growth curve.
14.	Calculation of thermal death point (TDP) & Thermal Death Time (TDT) of a microbial sample.
15.	Isolation of industrially important microorganism from natural resource. <ul style="list-style-type: none">• Antimicrobial compounds producing• Enzymes (Exo) producing• Organic acid producing

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BACHELOR OF SCIENCE (B.Sc.) IN BIOTECHNOLOGY
For Undergraduate (UG) Education

SEMESTER - 4
Skill Enhancement Course (SEC)

**Syllabus applicable to the students seeking admission in the
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B.Sc. Biotechnology w.e.f. the Academic Year 2023-24

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY

SEMESTER 4

SKILL ENHANCEMENT COURSE

BIOINFORMATICS

Course Objectives:

- The objective is to impart fundamental knowledge about computational biology and enhance their skill about in silico analysis which will help to provide ideal prediction in research and analysis.
- It acquired adequate knowledge & necessary skills about different computational tools as well as different algorithm which is favourable for sequence as well as structure based learning.

Course Outcome:

- Students will gain basic knowledge about sequence and structure based analysis
- They will also familiar with importance of in silico analysis and its application in biology as well as biological research.
- Course will provide combination of skills for dry lab

BT15030 - THEORY COURSE CONTENT

(2 Credits)

UNIT1	Introduction of Bioinformatics <ul style="list-style-type: none">• Introduction and history of bioinformatics: Goal, Scope, application, Limitation.• Introduction of NCBI and its application.• Biological databases: Introduction, file format and application of EMBL, DDBJ, Entrez, PubMed, GenBank, OMIM, Swiss Prot, PDB, KEGG database Pitfalls of Biological database.	7 lectures
UNIT2	Pairwise Sequence Alignment <ul style="list-style-type: none">• Alignment: Define alignment, Homology, similarity and identity of sequences.	8 lectures

	<ul style="list-style-type: none"> • Methods of alignment: Local and global alignment. • Algorithm use for alignment: Dot matrix method, Dynamic programming method: Needleman and Wunsch algorithm, Smith Waterman algorithm. Database similarity search: Basic Local Alignment Search Tool (BLAST), FASTA 	
UNIT3	<p>Multiple Sequence Alignment</p> <ul style="list-style-type: none"> • Define: Multiple sequence alignment (MSA) • Algorithm use for MSA: Exhaustive algorithm, Heuristic algorithm. Profiles, Motif: identification of motif and Domains in Multiple Sequence Alignment. • Phylogenetic: Define: Phylogenetic, Phylogenetic tree construction methods: Distance based methods, character based methods. 	8 lectures
UNIT4	<p>Structural Bioinformatics</p> <ul style="list-style-type: none"> • Protein structure classification • Protein Structure prediction: Secondary structure prediction, tertiary structure prediction • Types of RNA structure, RNA secondary structure prediction methods. protein-protein interaction. 	7 lectures
SUGGESTED READING		
<ol style="list-style-type: none"> 1. Xiong, J., 2006. Essential bioinformatics. Cambridge University Press. 2. Bioinformatics sequence and Genome analysis by Dawid W. Mount 3. Jiang, R., Zhang, X. and Zhang, M.Q. eds., 2013. Basics of bioinformatics: Lecture notes of the graduate summer school on bioinformatics of China. Springer Science & Business Media. 		