

VANITA VISHRAM WOMEN'S UNIVERSITY

SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY



**VANITA VISHRAM
WOMEN'S UNIVERSITY**

SURAT

**BACHELOR OF SCIENCE (B.Sc.) HONOURS IN
BIOTECHNOLOGY**

**Under Learning Outcomes Based Curriculum Framework
(LOCF)**

For Undergraduate (UG) Education

SEMESTER - 3

Core Courses (CC)

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

B.Sc. Biotechnology under LOCF w.e.f. the Academic Year

2021-2022

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 3

CORE COURSE PAPER 5

FUNDAMENTALS OF GENETICS

Course Objectives:

- 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 medallion principles.
- To make students understand about genetic linkage and inheritance.
- To differentiate prokaryotic and eukaryotic chromosome arrangement

Course Outcome:

Students will be able to understand,

- Able to understand non allelic interactions and allelic nature.
- Summarize the chromosomal inheritance.
- Distinguish the pro- and eukaryotic chromosome arrangement.
- Learn basic concepts of Developmental, Evolution and population genetics.

BT11090 - THEORY COURSE CONTENT

(4 Credits)

UNIT 1	Introduction: Historical developments in the field of genetics; Mendelian genetics: Mendel's Study of heredity; Applications of Mendel's Principles. Gene interactions: Allelic and non- allelic interactions: Gene Action: From Genotype to Phenotype	15 lectures
UNIT 2	Chromosome and genomic organization: Eukaryotic nuclear genome nucleotide sequence composition; Noncoding DNA; Genetic organization of prokaryotic and viral genome; Structure and characteristics of bacterial and eukaryotic chromosome	15 lectures

UNIT 3	Chromosome theory of inheritance: Sex-Linked Genes in Humans; Sex Chromosomes and Sex Determination; Dosage Compensation of X-Linked Genes. Variations in chromosome number and structure: Polyploidy, Aneuploidy and Rearrangements in chromosome structure.	12 lectures
UNIT 4	Genetic linkage, recombination and Crossing over; Chromosome mapping, cytological mapping, Linkage analysis in humans Extra chromosomal inheritance: Maternal inheritance; Cytoplasmic inheritance: Organelle heredity, Genomic imprinting Evolution and population genetics: Genetic variation, Allelic and genotype frequencies, Hardy Weinberg law, Nonrandom mating, Changes in allelic frequencies, Developmental Genetics, (Drosophila, C. elegans and Plants)	18 lectures

BT11100 - LAB COURSE CONTENT
(2 Credits)

1. Permanent and temporary mount of mitosis.
2. Permanent and temporary mount of meiosis.
3. Demonstration of - Barr body -Rhoeo translocation.
4. Karyotyping with the help of photograph.
5. Monohybrid Ratio and its Modification.
6. Dihybrid Ratio and its Modification.
7. Study of Trihybrid Ratio and back cross methods.
8. Chi-Square Analysis.
9. Gene Interaction.
10. Estimation of Linkage: Two Point Test Cross.
11. Estimation of Linkage: Three Point Test Cross.
12. Pedigree charts of some common characters like blood group, color blindness and PTC tasting.
13. Study of polyploidy in onion root tip by colchicine treatment.

SUGGESTED READING

1. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
4. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.
5. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 3

CORE COURSE PAPER 6

INTRODUCTION TO MICROBIOLOGY

Course Objectives:

- To make the students aware about the history of microbiology and how it developed.
- To give the idea on the basic concept of prokaryotes, their taxonomy, and their differentiation from eukaryotes.
- To explain about the organelles of a prokaryotic cell, their structure and functions.
- To give knowledge on microbial cultivation techniques and identification.
- To acquainted the students about nutritional requirements, growth, growth pattern of microbes and their control.

Course Outcome:

Students will be able to understand microbiology and its fundamentals. Students also can,

- Understand history, classification, relevance of microbiology in today's life and its development.
- Learn how to cultivate and maintain the microbial culture.
- Distinguish different types of microbes on the basis of their cellular characteristics.
- Apply the knowledge to control the microbial growth whenever applicable and
- Utilize this knowledge in safety measures to be followed while handling microbes or against microbial infection.

BT11110 - THEORY COURSE CONTENT

(4 Credits)

UNIT1	History and development of microbiology; Diversity of microbial world - systems of classification (including molecular approaches), microbial phylogeny and taxonomy, difference between prokaryotic and eukaryotic	10 lectures
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	cells; Morphology and cell structure of major groups of microorganisms eg. bacteria, algae, fungi, protozoa and unique features of viruses	
UNIT2	Prokaryotic and archaeal cell structure, Size, shape and arrangement; Structure external to cell wall – capsule and slime layer (glycocalyx), flagella, axial filaments, fimbriae; Cell wall; Structures internal to cell wall – cell membrane, cytoplasm, nucleoid, ribosomes, inclusions and endospores; Dyes, stains and staining techniques	15 lectures
UNIT3	Bacterial cultivation techniques - methods for isolation of pure culture, preservation and maintenance of pure culture, cultivation and maintenance of anaerobic organisms; Identification of microorganisms: conventional methods, sequencing, metagenomics	20 lectures
UNIT4	Growth and nutrition - nutritional requirements and types of bacteria, culture media and its types; Control of Microorganisms - physical, chemical and chemotherapeutic agents; Microbial growth - growth curve and generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria	15 lectures

BT11120 - LAB COURSE CONTENT

(2 Credits)

1. Wet mount and hanging drop technique.
2. Staining methods: simple staining (acidic & basic), gram staining, acid fast staining, capsule, cell membrane, flagella and endospore staining.
3. Preparation of media (broth, plate, slant and stab).
4. Demonstration on different sterilization techniques e.g. dry heat, moist heat, filtration etc.
5. Isolation of bacteria by streak plate, pour plate and spread plate method.
6. Isolation of anaerobic bacteria.
7. Biochemical characterization of pure culture.
8. Determination of bacterial cell/fungal spore size by micrometry.
9. Enumeration of microorganism - total & viable count.

10. Bacterial growth curve and find out growth rate and generation time.

SUGGESTED READING

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). Introductory Mycology. 4 th edition. John and Sons, Inc.
2. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
3. Kumar HD. (1990). Introductory Phycology. 2nd edition. Affiliated East Western Press.
4. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/Benjamin Cummings.
5. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9 th edition. Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. Prescott, Harley and Klein's Microbiology. 10th edition. McGraw Hill Higher Education.
9. Patel, R. J., Experimental Microbiology Vol 1 & 2 (5th Edition), Aditya Publication.
10. Aneja K. R., Experiments In Microbiology, Plant Pathology And Biotechnology. 5th edition. New age international publication.

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS
SEMESTER 3
CORE COURSE PAPER 7

BIO-ANALYTICAL TOOLS AND TECHNIQUES

Course Objectives:

- To explain students about analytical techniques along with their theory, working principal and possible applications.
- To develop the skills to understand the theory and practice of bio analytical techniques.
- To provide scientific understanding of analytical techniques and detail interpretation of results.
- To bridge the gap between academics, research and industry.

Course Outcome:

- To be able to use selected analytical techniques.
- Familiarity with working principals, advantages and limitations of analytical techniques.
- To understand the strengths, limitations and creative use of techniques for problem-solving.

BT11130 - THEORY COURSE CONTENT
(4 Credits)

UNIT 1	Microscopy and Spectrophotometry: Simple microscopy, Phase contrast microscopy, Dark field microscopy, Confocal microscopy, Florescence microscopy, Electron microscopy (TEM and SEM), Absorption and emission spectroscopy; Spectrophotometry (visible, UV, infra- red), Principle and law of absorption fluorimetry, colorimetry	15 lectures
UNIT 2	Cell Separation and Chromatography: Centrifugation, Cell fractionation techniques, Isolation of sub-cellular organelles and particles; Introduction to the principle of chromatography- Paper chromatography, Thin layer chromatography, Column chromatography [Silica and gel filtration, Affinity	15 lectures

	and ion exchange chromatography], Gas chromatography, Gas liquid chromatography, HPLC	
UNIT 3	Electrophoretic techniques: Introduction to electrophoresis, Starch-gel electrophoresis, Polyacrylamide gel (native and SDS-PAGE) electrophoresis, Agarose-gel electrophoresis, Pulse field gel electrophoresis, Immuno- electrophoresis, Isoelectric focusing, Hybridization, Western blotting	15 lectures
UNIT 4	PCR; RT-PCR; Mass Spectrometry; Detection and Measurement of Radioactivity; Cell cytometer; NMR; introduction to X-ray diffraction (XRD)	15 lectures

BT11140 - LAB COURSE CONTENT

(2 Credits)

1. Observation of morphological characteristics of yeast/protozoa by phase contrast microscopy and dark field microscopy.
2. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH.
3. Preparation of the sub-cellular fractions of rat liver cells/any suitable tissues.
4. Preparation of protoplasts from leaves.
5. Separation of amino acids by paper chromatography.
6. To identify lipids in a given sample by TLC.
7. Separation of DNA or RNA by gel electrophoresis.
8. Native gel electrophoresis of proteins.
9. SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions.
10. Demonstration on PCR.
11. To determine Alkaline phosphatase enzyme activity from sprouted mung bean and to study effect of temperature, pH and kinetics (K_m and V_{max}) of alkaline phosphatase enzyme.

SUGGESTED READING

1. Keith Wilson, John Walker. Principles and Techniques of Biochemistry and Molecular Biology. 7th edition. Cambridge University Press. ISBN: 9780521516358.

2. Willey JM, Sherwood LM, and Woolverton CJ. Prescott, Harley and Klein's Microbiology. 10th edition. McGraw Hill Higher Education.
3. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
4. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
5. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
6. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
7. Dubey R. C., Advanced Biotechnology. S. Chand.
8. Charles R. Cantor; Paul R. Schimmel, Biophysical Chemistry: Techniques For The Study Of Biological Structure And Function (Pt. 2). W. H. Freeman and Company, 1980-04-15.