

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 - 4

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 4

CORE COURSE PAPER 8

MOLECULAR BIOLOGY

Course Objectives:

- Demonstrate knowledge and understanding of the vital molecules such as DNA, RNA, protein
- Demonstrate knowledge and understanding the principles that govern DNA damage and repair mechanism
- To develop the ability to think critically about Transcription and RNA processing
- To give Students a brief study on regulation of gene expression

Course Outcome:

- Exhibit a knowledge base in genetics, cell and molecular biology
- Revelation clear and concise communication of scientific data.
- Engage in the review of scientific literature in the areas of biomedical sciences critique
- Professionally present primary literature articles in the general biomedical sciences field.

BT11150 - THEORY COURSE CONTENT

(4 Credits)

UNIT 1	DNA structure and replication: Replication of DNA in prokaryotes and eukaryotes, Semiconservative nature of DNA replication, Replication in Bacterial cells, The structure & Functions of DNA Polymerases, Replication in Eukaryotic Cells	15 lectures
UNIT 2	DNA damage, repair and homologous recombination: DNA damage and repair- Causes and types of DNA damage; Mechanism of DNA repair- Photoreactivation, Base excision repair, Nucleotide excision repair, Mismatch repair, Translation synthesis, Recombinational repair, Nonhomologous end joining; Homologous recombination: models and mechanism	10 lectures

UNIT 3	Transcription and RNA processing: The Relationship between Genes, Proteins, and RNAs, RNA structure and types of RNA, Transcription in Bacteria: Prokaryotic RNA polymerase, Role of sigma factor, Promoter, Initiation, elongation and termination, Transcription in Eukaryotes- Eukaryotic RNA polymerases, Transcription factors, promoters, enhancers, Mechanism of transcription initiation, promoter clearance and elongation, RNA Processing in Eukaryotic Cells: RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing	17 lectures
UNIT 4	Translation & Regulation of gene expression: Genetic code and its characteristics, Prokaryotic and eukaryotic translation- Ribosome structure and assembly, Charging of tRNA, Aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Regulation of gene expression in prokaryotes- Operon concept (inducible and repressible system), Riboswitches, Overview of Gene regulation in Eukaryotes	18 lectures

BT11160 - LAB COURSE CONTENT

(2 Credits)

1. Preparation of solutions for Molecular Biology experiments.
2. Isolation of chromosomal DNA from bacterial cells, plant cells and animal cells.
3. Isolation of Plasmid DNA by alkaline lysis method.
4. Agarose gel electrophoresis of genomic DNA & plasmid DNA.
5. Preparation of restriction enzyme digests of DNA samples

SUGGESTED READING

1. Karp, Gerald. *Cell and molecular biology: concepts and experiments*. VI Edition John Wiley & Sons, 2009.
2. De Robertis, E.D.P. and De Robertis, E.M.F. *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia, 2006.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco, 2009.

4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., *Molecular Biology of the Gene* (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub. 2008.

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 4

CORE COURSE PAPER 9

IMMUNOLOGY

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, immunodeficiency and different types of vaccines

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

BT11170 - THEORY COURSE CONTENT

(4 Credits)

UNIT 1	Historical Perspective: Major contributions, Introduction to Immunology: Types of Immunity (Active, Passive & Herd), Hematopoiesis, Structure, Function & Properties of Immune cells, organs & Microenvironments of Immune system, Cells of Immune system: Lymphoid cells, Mononuclear cells, Granulocytes, Mast cells, Dendritic cells, Primary Lymphoid Organs: Thymus and Bone Marrow, Secondary Lymphoid Organs: Lymph node & Spleen	15 lectures
UNIT 2	Innate (non-specific) Immunity: First Line of defense (Physical, Chemical & Biological); Anatomic, Physiological, Phagocytic & Inflammatory barriers	10 lectures

	Second Line of defense (Humoral, Inflammation & Phagocytosis) Adaptive (specific) Immunity: Cellular Immunity, Generation & Functions of Humoral Immunity	
UNIT 3	Antigen & Antibody: Recognition of foreignness, MHC, Antigen: Characteristics & types, Antigen Processing and Presentation, B-Cell Biology: B-cell activation, BCR, Antibody: Structure, types, diversity, functions and clonal selection, Monoclonal & polyclonal antibodies, T-Cell Biology, Complement system	17 lectures
UNIT 4	Antigen-antibody Interactions: Types & Principles of antigen-antibody reactions (Affinity, Avidity & cross reactivity), Visualization of antigen antibody complexes: Precipitation reactions, immuno-electrophoresis, Agglutination reactions, Immunofluorescence techniques, ELISA, RIA, ELISpot assay, Western blotting, Immuno-electron Microscopy, Overview of types of Hypersensitivity reactions, Vaccines	18 lectures

BT11180 - LAB COURSE CONTENT

(2 Credits)

1. To study ABO and Rh Blood grouping by slide method and tube method
2. To study precipitin reaction by immuno-diffusion
3. Simple immuno-diffusion
4. Double immuno-diffusion
5. ELISA for detection of HIV
6. Immunologic pregnancy test
7. Widal test (Slide test & Tube Test)
8. Rapid Plasma Reagin (RPR) Test or Venereal Disease Research Laboratory test (VDRL) Test for detection of Syphilis.
9. To detect the presence of Rheumatoid Factor (RF) which are produced during Rheumatoid arthritis (RA).
10. To detect C-reactive protein in human serum by latex agglutination slide test.
11. Cross-matching, Coomb's test (demonstration)

SUGGESTED READING

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. *Immunology*. 7th -12th edition. W. H. 2003.
2. Abbas, A.K. Lichtman, A.M. and Pober, J.S. *Cellular and Molecular immunology* 3rd edition Philadelphia: W.B. Saunders. 1997.
3. Roitt, LM. *Essentials of Immunology*, Willey and Black Well Scientific. 13th Edition. 2017.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. Prescott, Harley, and Klein's *microbiology*. 7th -12th edition. New York: McGraw-Hill Higher Education 2008.
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 10

FERMENTATION TECHNOLOGY

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:

- 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

BT11190 - THEORY COURSE CONTENT

(4 Credits)

UNIT 1	Introduction to fermentation: Introduction to fermentation process, Range of fermentation processes and its chronological development, Basic principles components of fermentation technology, Types of microbial culture and its growth kinetics– Batch, Fed batch and Continuous culture	15 lectures
UNIT 2	Isolation and Improvement of Industrially important microorganisms: Isolation of Industrially important microorganisms, Screening of Industrially important microorganisms, Improvement of strains producing primary and secondary metabolites Media for Industrial Fermentations: Typical media for fermentation, Medium formulation, Components of media: water, energy source, carbon source,	10 lectures

	Nitrogen source, Minerals, Growth factors, Nutrient recycle, Buffers, Precursors and metabolic regulators, oxygen, antifoams, Media Optimization, Animal cell fermentation media	
UNIT 3	Culture preservation and Inoculum development: Preservation of Industrially important microorganisms; continuous metabolic active state & suspended metabolic state Inoculum development: Criteria for transfer of inoculum, Development of inoculum for animal cell processes, yeast, bacterial processes, mycelial processes, Aseptic inoculation of plant fermenters	17 lectures
UNIT 4	Design of Fermenter: Basic functions of fermenter, Aseptic operation and containment, Fermenter 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	18 lectures

BT11200 - LAB COURSE CONTENT

(2 Credits)

1. Bacterial growth curve.
2. Calculation of thermal death point (TDP) & Thermal Death Time (TDT) of a microbial sample.
3. Isolation of industrially important microorganism from natural resource.
4. Antimicrobial compounds producing
5. Enzymes (Exo) producing
6. Organic acid producing
7. Volatile compounds producing
8. Extraction and purification of enzymes by salting-out method.
9. Extraction and purification of Lysozyme from egg-yolk using ion-exchange chromatography (demonstration).

SUGGESTED READING

1. Casida LE. *Industrial Microbiology*. 1st edition. Wiley Eastern Limited 1991.

2. Crueger W and Crueger A. *Biotechnology: A textbook of Industrial Microbiology*. 2nd edition. Panima Publishing Co. New Delhi. 2000.
3. Patel AH. *Industrial Microbiology*. 1st edition, Macmillan India Limited. 1996.
4. Stanbury PF, Whitaker A and Hall SJ. *Principles of Fermentation Technology*. 2nd edition, Elsevier Science Ltd. 2006.

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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 - 4

GENERIC ELECTIVE COURSE (GEC)

**Syllabus applicable to the students seeking admission in the
Bachelors Programs under LOCF w.e.f. the Academic Year
2021-2022**

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 4

GENERIC ELECTIVE COURSE PAPER 4

MOLECULAR DIAGNOSTICS

Course Objectives:

- The objective of the course is to develop a brief idea of various diagnostic testing used in day-to-day life.
- This could enrich students' knowledge on various techniques applied for pathology, cancer diagnostics, Genetic testing and immune-testing.

Course Outcome:

- After this course students would be able to understand diagnosis testing.
- They would understand the techniques used in everyday life as diagnosis.

BT31070 - THEORY COURSE CONTENT

(4 Credits)

UNIT 1	Examination of Blood-Routine and special tests Examination of Urine - Routine and Special tests Examination of Stool - Routine and Special tests Examination of Sputum - Routine and Special tests Semen examination - Routine and Special tests Examination of CSF - Routine and Special tests Examination of various body fluids-Pleural Fluid, Pericardial Fluid, Synovial Fluid, Ascetic Fluid Various methods of detecting HCG levels	15 Lectures
UNIT 2	Tuberculin skin test Serological tests for leprosy Serological tests for syphilis Serological tests for HIV	15 Lectures

	Enzyme immunoassay (EIA) Antinuclear antibody HLA typing	
UNIT 3	CT scan MRI Nuclear Scan Bone Scan Ultrasound X-Rays Biopsy PET Scan Mammography tests	15 Lectures
UNIT 4	Single gene testing Panel testing Large-scale genetic or genomic testing Prenatal testing Carrier testing Predictive or predispositional genetic testing	15 Lectures
BT31080 - LAB COURSE CONTENT (2 Credits)		
<ol style="list-style-type: none"> 1. ABO & Rh blood grouping. 2. Demonstration of pregnancy test kit. 3. Demonstration of HIV diagnosis by ELISA 4. Analysis of blood and urine reports (as asked by supervisor). 5. Preparation of charts of various cancer diagnosis tests (as allotted by supervisor). 6. Preparation of charts of various genetic tests (as allotted by supervisor). 		
SUGGESTED READING		
1. Robbins & Cotrans. <i>Pathologic Basis of disease</i> . 10 th Edition. 2020		

2. C D M Fletcher. *Diagnostic Histopathology of tumors*. 5th Edition, 2019
3. A V Hoffbrand. 4th Edition. *Post Graduate Hematology*. 2005
4. Dr. Tejinder Singh. *Atlas & text book of hematology*. 2016
5. Biochemistry- *Harper's Illustrated Biochemistry* – Text book of Biochemistry, 6th edition, 2013.
6. Roitt, LM. *Essentials of Immunology*, Willey and Black Well Scientific. 13th Edition. 2017
7. Harsh Mohan, *Textbook of pathology*. 6th Edition, 2013
8. MA Hayat. *Methods of Cancer diagnosis, Therapy and Prognosis*. Volume 6. 2010
9. Frances Fischbach. *A manual of Laboratory and diagnostic testing*. 9th Edition
10. Warren Levinson. *Review of Medical Microbiology and Immunology*. 2018

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SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY



**VANITA VISHRAM
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SURAT

**BACHELOR OF SCIENCE (B.Sc.) HONOURS IN
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**Under Learning Outcomes Based Curriculum Framework
(LOCF)**

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 under LOCF w.e.f. the Academic Year

2021-2022

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 4

SKILL ENHANCEMENT COURSE PAPER 2

VIROLOGY

Course Objectives:

- To provide students with an introduction to viruses and their importance in nature.
- To enable the students to understand about various viral diseases of plants and human being.

Course Outcome:

- Basic principles of virology, structure, replication strategies, General method for cultivation and to identify viruses, viral vaccine and antiviral drugs and its importance to society.
- Structural organization and life cycle of bacteriophage, viruses of other organism.
- General characters, morphology, transmission, epidemiology, symptoms and control of plant viruses.
- Etiology, symptoms, pathogenic mechanisms, lab diagnosis, treatment, epidemiology, prevention and control of viruses important to human.

BT15020 - THEORY COURSE CONTENT

(4 Credits)

UNIT 1

Introduction to virology: Brief outline of virology, Theories of viral origin, The early period and the modern period History & Development of concepts of viruses, General properties of viruses, Virus Morphology , Taxonomy & Classification of Viruses: General taxonomy, The Baltimore system of classification, ICTV system for taxonomy, Viral cultivation and assay: Initial detection and isolation, Hosts for virus cultivation, Recognition of viral growth in culture, Virus cultivation, Quantitative assay, Viral hemagglutination, Viral multiplication, Assay of infectivity, General methods of diagnosis and serology, Virioids, Prions, Satellite RNAs and virusoids, Viral vaccines and antiviral agents

**15
lectures**

UNIT 2	Bacterial Viruses: Genome, structural organization and Life cycle of Φ X174, M13, T4 and lambda, Temperate & Virulent Phages, Phage-borne genes for bacterial toxins & other proteins affecting host phenotype, Multiplication/Replication: Lytic & Lysogenic cycles, One step growth curve	15 lectures
UNIT 3	Plant viruses, General characters, morphology, transmission, epidemiology, symptoms and control of following plant viruses: Tobacco mosaic virus,, Cauliflower mosaic virus, Rice tungro virus, Tomato leaf curl virus, Sugarcane mosaic virus, Potato virus Y & X, Cassava mosaic virus, Tomato spotted wilt virus, Cotton leaf curl virus	13 lectures
UNIT 4	Human viruses, Etiology, symptoms, pathogenic mechanisms, lab diagnosis, treatment, prevention and control for the following virus important to human: DNA viruses, Adeno viruses, Herpes viruses (1 & 2), Papilloma virus, Hepatitis B viruses, RNA viruses, Influenza virus, Rabies virus, Corona virus, HIV, Oncolytic viruses	12 lectures

SUGGESTED READING

1. Ananthanarayan R and Jeyaram Paniker CK. *Text Book of Microbiology*, 6th Edn. Orient Longman, Chennai. 1994.
2. Dubey RC and Maheswari DK . *A text book of Microbiology*, Revised Multicolour edition, S. Chand Publishers, New Delhi. 2005.
3. Pelczar and Kreig. *Microbiology* 5th edition. Tata McGraw Hill, New Delhi. 2006.
4. Willey J.M., Sherwood L.M. and Woolverton C.J., *Prescott's Microbiology*, 10th Edition, McGraw - Hill Education, (ISBN: 978-981- 3151-26-0). 2017.
5. *Fields Virology* Vol 1 and 2. B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, B. Roizman, and S.E. Straus, eds.), 3rd Edition. Lippincott-Raven, Philadelphia, PA.
6. *Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses*. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka. Latest edition / Pub. Date: December 2003 Publisher: American Society Microbiology--- Chapters 3-13.

7. Luria SE, Darnel JE Jr, Baltimore D and Campbell A (1978) *General Virology*, 3rd Edn. John Wiley & Sons, New York
8. Roger Hull. *Mathews' Plant Virology*. (4th Edition). Academic press-A Harcourt Science and technology company, New York. 2002.
9. Waginer and M. Hewlett *Basic Virology*, Blackwell Publishers, 3rd edition.
10. Cann A. J. *Principles of molecular virology*, Elsevier academic press, 4th edition. 2005.