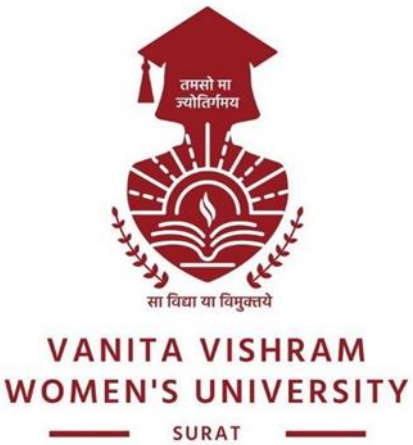
VANITA VISHRAM WOMEN'S UNIVERSITY

SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY



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, Translesion 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), Haematopoiesis, 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 defence (Physical, Chemical & Biological); Anatomic, Physiological, Phagocytic & Inflammatory barriers	**10 lectures**

	Second Line of defence (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 letax 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*.7 th -12thedition. 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.