

SARDAR PATEL UNIVERSITY

BSc Biotechnology Programme Outcomes

- After successful completion of B.Sc Biotechnology Course the graduates
- Eligible for pursuing higher education, M.Sc. programmes in the different field of life science.
- Eligible for doing jobs in pharmaceutical and biotechnological Industry.
- Understand the potentials, and impact of biotechnological outcome on environment and to find out the sustainable solutions to problems regarding environment, medical, agriculture sector, etc.
- Can work individually as well as in team to thrive in multidisciplinary environment.
- Both oral and written communication skills

SARDAR PATEL UNIVERSITY
BSc Biotechnology; V semester
US05CBIT21: Molecular Biology & Genetics
(4 PERIODS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

Unit-I: Eukaryotic genome organization. Chromosome structure, types and banding (G,C,Q,R,T)- Nucleosome, chromatin, DNA binding proteins Histones & Non-histones DNA protein interaction. Types of binding motifs – Zinc finger motifs, leucine zipper, helix loop helix, helix turn helix.

Unit-II: Replication in eukaryotes – replication Enzymes & proteins involved in replication with its function. Mitochondrial DNA replication. DNA- damage & repair, mismatch repair, direct repair, excision repair, SOS repair and post replicative repair.

Unit-III: Transcription in Eukaryote: Types of RNA polymerase, types of promoter, enhancers & silencers, initiation, elongation, termination, post transcriptional modification – types of intron, splicing of m-RNA, t-RNA, modification of 5'-3' ends. Translation in eukaryote, post-translational modification.

Unit-IV :Recombination- site specific and homologous, (Holliday model). Role of rec genes and protein. Mobile genetic element prokaryotic-IS and Composite and eukaryotic-Ac/DS element. Retrotransposon- properties , types – LTR and NON LTR. Significance of retrotransposon in eukaryotes.

Reference Books

Genes—Benjamin Lewin

Molecular biology of the gene-Watson et al

Molecular biology of the cell- Alberts et al

Learning outcome: Students will be understanding the genetic material and its mechanism to copy, and decode the information at molecular level.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; V semester
US05CBIT22: Transgenics
(4 CREDITS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

Unit-I---Transgenic technology-Strategy. Gene transfer methods -physical(microinjection, electroporation, gene gun) chemical (liposome,PEG Ca co precipitation)& vector mediated(Ti-plasmid and retrovirus), screening of transgenics- Reporter genes (selectable & scorable markers). Advances of transgenic technology, strategy for gene inhibition.

Unit-II--Transgenic technology--introduction to functional genomics(microarray). Human genome project –objective, process and significance. Molecular marker-introduction, properties of ideal molecular markers. Types of molecular markers for analysis of genomes – RFLP, RAPD, AFLP, EST, SNPs, Mini and microsatellite.

Unit III-Agricultural biotechnology- Introduction and scope. Development of insect resistant(Bt-crop) and herbicide resistant (glufosinate) plants and the improvement of nutritional value in plants (golden rice, flavor savor tomato). Cryopreservation storage and importance of germplasm. A brief introduction to edible vaccine.

Unit-IV--Transformation and Evolution of continuous cell line. Hybridoma technology - introduction and steps for construction of Hybridoma cell lines. Screening of Hybridoma cell lines. Methods for production of monoclonal antibodies through hybridoma cell lines and Genetic engineering. Introduction to transgenic animals-process to create transgenic animals and their application (mice).Introduction to nuclear transfer technology (Dolly sheep), Process to create knock out mice and its significance.

Reference Books:

Plant Biotechnology- P K Gupta
Animal cell culture- Freshney
Gene manipulation – G.B. Old & Primrose
Molecular Biotechnology – Glick & Galston
Genetics-- Clug & Cummings
Gene Cloning by T.A. Brown.

Learning outcome:

Students would be able to understand the mechanism behind genetic modification of plants and animals for their improvement.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; V semester
US05CBIT23: R-DNA TECHNOLOGY
(4 CREDITS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

Unit-I: Recombinant DNA technology---Introduction and steps involved, restriction enzymes, nucleic acid modifying enzymes-klenow fragment of DNA pol-I, alkaline phosphatase, polynucleotide kinase, reverse transcriptase, DNA ligase, DNase-1, RNase, methylase, exonuclease.

Unit-II: Prokaryotic cloning and expression vectors- Bacteriophage- λ vectors- replacement & insertional vectors cosmid, phagemid. BAC. Cloning and expression vectors- Bacteriophage- λ vectors- replacement & insertional vectors cosmid, phagemid. BAc, yeast vectors- yEP, yIP, yCP, eukaryotic vectors- SV-40, retroviral vector, MAC; plasmid based vectors- co-integrate & binary vectors.

Unit III: Eukaryotic cloning and expression vectors-yeast vectors-YEP, YIP, YCP, SV-40, retroviral vector, MAC; plasmid based vectors- co-integrate & binary vectors. Introduction into eukaryotic expression system.

Unit-IV: Introduction to Bioinformatics. Significance of Bioinformatics in Biological Science- Biological Databases (Accession codes & identifications) Examples of Biological Database (A) Nucleotide sequence Databases (B) Protein sequence databases (EMBL, Gene Bank). Primary Nucleotide sequence, databases, protein sequences, databases).

Reference books:

From genes to clones-Ernst winnaker
Genetic engineering-Old & Primrose;
Biotechnology and genomics-P K Gupta
Genes and cloning – T A Brown
A text book of biotechnology- R C Dubey

Learning outcome: Students would be able to understand how DNA molecules from different sources can be made to combine and transfer from one organism to other. Students will also learn to use computer as a tool for applying his knowledge of biotechnology.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; V semester
US05CBIT24-- IMMUNOLOGY
(4 CREDITS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

UNIT-I Introduction to immune system, types of immunity (innate and acquired, active and passive, humoral and cell-mediated). Immune response-primary and secondary. Antigen-Definition, properties and classification, epitopes and haptens, Antibody- Definition, structure, type and function, blood groups types (ABO and Rh system).

Unit-II: Antigen – Antibody interactions – Agglutination, precipitations, immunodiffusion, ELISA- Introduction, principle and types. B and T lymphocytes, Cytokines (IL-2, TNF- α and β , chemokines and Interferons) introduction and role of cytokines in immune response.

Unit III: complement system- function, components and activation of different pathways. Immunodeficiency- primary and secondary. Major Histocompatibility complex-structure, types, and functions. Hyper sensitivity Autoimmunity – Introduction and types.

UNIT-IV : Apoptosis: Regulation and control of apoptosis. Caspases, Activation of Apoptotic pathways by internal and external stimuli. Cell mediated immunity – NK cells mechanism of Action & importance. Cancer- Introduction, Types, Mechanism, Concept of Protooncogenes and oncogenes.

Reference books

Genes –Levin;

Essential Immunology-Roit

Immunology- Kuby

Molecular biology of the gene- Watson

Learning outcome: Students would be able to acquire the knowledge of our body's defense system--immune system and its functioning in fighting against diseases.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; V semester
US05CBIT025: PRACTICAL
(6 CREDITS, 12 HOURS, 150 MARKS)
(Effective from June 2020)

1. isolation of DNA from Fungi
2. isolation of RNA from plant.
3. Separation of DNA (Chromosomal & Plasmid) by Agarose gel electrophoresis
4. Chromosome banding (G banding)
5. Separation of Proteins by SDS PAGE
6. PCR
7. isolation of antibiotic resistant microorganisms by replica plating
8. effect of U.V. as a mutagen on *Serratia marcescens*
9. Total count of WBC/RBC
10. Radial Immuno Diffusion
11. Dot- ELISA
12. Widal test(slide test)
13. Differential count of leucocytes
14. Estimation of Hb by Sahli's method
15. Quantitative Precipitin Assay

SARDAR PATEL UNIVERSITY
BSc Biotechnology; V semester
US05DBIT026: MOLECULAR TECHNIQUES
Discipline specific
(2 CREDITS, 2 HOURS, 70 MARKS)
(Effective from June 2020)

Unit-I--Reverse transcription and construction of c-DNA library & genomic DNA library. Recombinant selection and screening, immunochemical, nucleic acid hybridization, and colony hybridization, DNA fingerprinting-process and application.

Unit-II-- Southern,Western, Northern blotting Dot-Blot, differential screening. In situ hybridization, FISH (radioactive and non radioactive detection of hybridization) Autoradiography.

Unit-III-- Electrophoretic separation of nucleic acids (Agarose gel & Poly acrylamide gel electrophoresis). PCR introduction types(RT PCR, Multiplex PCR, Gradient PCR) and its applications.

Unit_IV-- DNA sequencing—Sanger's method, Maxam Gilbert's method cleavage automated and pyrosequencing. DNA foot printing types(Gel retardation and Dnase-1 method) and application.

Reference books

From genes to clones-Ernst winnaker

Genetic engineering-Old & Primrose; Biotechnology and genomics-P K Gupta

Genes and cloning – T A Brown ; A text book of biotechnology- R C Dubey

Learning outcome: Through this paper the understanding of various techniques using biomolecules for various purposes will be made clear to students.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; VI semester
US06CBIT21: Molecular Communications
(4 CREDITS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

Unit-I: Fluid mosaic model of membrane. Functions of plasma membrane. Chemical composition of membrane—Types & functions of lipids, proteins and carbohydrate. Membrane fluidity. Membrane transport and cell junctions.

Unit II--Cytoskeleton- composition and function—Polymerization, depolymerization of Microtubules, intermediate filaments and microfilaments, associated proteins, Functions and significance. Molecular motors (dynein kinesin and myosin).concept of sarcomere and muscle contraction and relaxation. Introduction to rigor mortis.

Unit-III: Cell signaling—basic characteristics of cell signaling & significance, second messenger(C- AMP,ATP/GTP), structure and role of G protein coupled receptors (GPCR) & Receptor tyrosine kinases (RTK) in signaling pathway.

Unit-IV: Hormones- Introduction, chemical nature and types (peptides, steroids, amines and fatty acids) mechanism of action of hormones. Plant hormones --types ((auxin, cytokinin, GA, ABA ,ethylene) and their roles in plant growth.

Reference Books:

Human physiology by Chaterjee and Chaterjee
Human physiology by Tortora
Biochemistry by Zubay; Biochemistry by Stryer
Text book of biochemistry- Vasudevan & Shreekumari
Biochemistry -Lehninger

Learning outcome: Students will know about the structures and working of molecules involved in sensing and responding to signals (external/internal) and to communicate with other parts of body for proper functioning of organisms.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; VI semester
US06CBIT22: INDUSTRIAL BIOTECHNOLOGY
(4 CREDITS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

Unit-I--A brief introduction fermentor or bioreactors. Structural component of typical fermentor. Introduction to aeration and agitation and their effect, C_{crit} and KL_a , pH and temperature on fermentation, Instrumentation for control of process (Temperature and pH electrodes), Downstream processing- methods and application.

Unit- II--Typical fermentation process (ethanol production , organic acid, vinegar, Red and white wine, sparkling wine, champagne. Production of beer, Overview for spoilage of wine. Production of enzymes and antibiotics through fermentation. Introduction to food Spoilage and their preservation.

Unit-III- Microbiology of waste water treatment, aerobic process - activated sludge, oxidation ponds, trickling filter, rotating discs, rotating drums, oxidation ditch. Anaerobic process - anaerobic digestion, anaerobic filters. Treatment schemes for waste waters of dairy and tannery industries

Unit-IV---Biotechnology: risks & ethics. Biosafety : guidelines and regulations, intellectual property rights (IPR) and protection. Forms of protection –patents- introduction, process and patenting strategies, significance of patent, Patenting of biological materials. patenting status in India. A brief overview for copy rights, trade secrets and trade marks. Plant variety protection; World intellectual property organization (WIPO) general agreement of tariffs and trade (GATT) and trade related IPR (TRIPS).

Reference books

Environmental pollution control engineering-C S Rao

Industrial microbiology-Whitaker

Industrial microbiology-A H Patel

General microbiology- Frobisher

A text book of biotechnology – R C Dubey

Learning outcome: This paper will make clear the understanding of students about fermentation process and its applications. students will be aware of the IPR, and copyrights also.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; VI semester
US06CBIT23: METABOLISM
(4 CREDITS, 4 HOURS, 70 MARKS)
Semester -V (Effective from June 2020)

UNIT--I: Photosynthesis dark reaction: Calvin cycle, regulation, Photo respiration, C₄ and CAM pathways in plants. Oxidative phosphorylation, The electron transport chain - its organization and function. Peter Mitchell's chemiosmotic hypothesis and Proton motive force. FoF₁ ATP synthase, structure and mechanism of ATP synthesis. Glyoxylate cycle in plant.

UNIT-II Glycolysis: overview, reactions, regulations, Pentose phosphate pathway and its importance, Citric acid cycle, Malate aspartate shuttle, Glyceraldehyde-3-phosphate dehydrogenase shuttle,. Glycogen synthesis, glycogen breakdown, gluconeogenesis.

Unit -III- Fatty acid synthesis--FAS complex enzyme. Synthesis of saturated, unsaturated, odd and even chain fatty acids. Fatty acid oxidation: β oxidation of saturated, unsaturated, odd and even numbered and branched chain fatty acids, regulation of fatty acid oxidation, Ketone-body metabolism.

Unit IV- Nucleotide biosynthesis. De novo and salvage pathway. Digestion and absorption of dietary proteins. Role of essential and non-essential amino acids in growth and development. Transamination, role of pyridoxal phosphate, glucose-alanine cycle, urea cycle.

Reference books:

Biochemistry by Zubay;

Biochemistry by Stryer

Text book of biochemistry- Vasudevan & Shreekumari

Biochemistry -Lehninger

Learning outcome: Students will get an understanding of how living organisms get energy at molecular level through metabolic activities.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; VI semester
US06CBIT24: ENZYMOLOGY
(4 CREDITS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

Unit-I: Enzymology—General characteristics and classification, definition of holoenzymes, coenzymes, apoenzymes, cofactors, activators, inhibitors, units of enzyme activity, isoenzymes, turn over number, specific activity, first order and zero order reactions. Structure of active site of enzymes, specificity of enzyme action- Types and factors affecting enzyme activity. Brief introduction of allosteric enzymes.

Unit-II: Mechanism of action of enzymes--General features - proximity and orientation, strain and distortion, acid-base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues. Coenzymes in enzyme catalyzed reactions. Structure, vitamin precursors, types of reaction involved in: TPP, FAD, NAD, pyridoxal phosphate, biotin, coenzyme A, tetrahydrofolate and lipoic acid.

Unit III: Enzyme kinetics—Derivation of Michaelis and Menten equation and its modifications (Line weaver & Burk plot, Eadie- Hofstee and Hannes & Woolf plots). Enzyme Inhibition - competitive, non competitive, uncompetitive, mixed & substrate inhibition

Unit IV: Applications of Enzymes-- Enzymes as reagents (glucose oxidase, cholesterol oxidase); Marker enzymes in diagnostics (SGPT, SGOT, creatine kinase); Introduction to immobilization and its applications. Industrial applications of enzyme-amylase, protease and lipases(food, textile & detergent)

Reference books:

Enzymology by Palmer;

Fundamentals of Enzymology – Nicolas Price & Lewis Stevens

Biochemistry by Zubay;

Biochemistry by Stryer ;

Text book of biochemistry- Vasudevan & Shreekumari;

Biochemistry -Lehninger

Learning outcome: Through this paper students will learn the catalytic control of biochemical reactions and how these catalytic proteins can make a significant role in our day to day work also.

SARDAR PATEL UNIVERSITY
BSc Biotechnology; VI semester
US06CBIT025: PRACTICAL
(6 CREDITS, 12 HOURS, 150 MARKS)
(Effective from June 2020)

1. Estimation of Gluconic acid
2. Estimation of Alcohol
3. Estimation of Penicillin
4. Water analysis
5. Determination of Dissolved oxygen(DO) of waste water
6. Determination of COD of waste water
7. Determination of K_M & V_{Max} of amylase.
8. effect of pH/ Temperature/ Incubation time on amylase activity
9. Estimation of SGPT/SGOT/ Creatine kinase
10. Immobilization of yeast cells by calcium alginate
11. Estimation of cellulase activity by CMC & Filter paper.
12. Food analysis
13. Effect of Hormones on seed germination (Auxin, G.A, Cytokinin)
14. Antibiotic sensitivity by Bioassay (Cup- borer)
15. Effect of antimicrobial agent on the growth of microorganisms
16. Oligodynamic action of heavy metal (copper) on the growth of microorganisms

SARDAR PATEL UNIVERSITY
BSc Biotechnology; VI semester
US06DBIT26: Discipline specific VIROLOGY
(4 CREDITS, 4 HOURS, 70 MARKS)
(Effective from June 2020)

Unit I: History of viruses. Classification of viruses. characteristic features of viruses. General structure (nucleic acids, capsids, envelope) of viruses. Structure of Bacteriophage and TMV. Multiplication, movement, symptoms, transmission and control measures of plant viruses. Introduction to viroids.

Unit-II: Assay of viruses -physical counts, Hemagglutination, plaque assay, pock method, end point method. Multiplication of bacterial viruses--lytic cycle -one step growth, lysogeny -establishment of lysogenic state(Prophage cycle), and significance of lysogeny.

Unit-III: Animal viruses- structure and multiplication of adenovirus, Hepatitis A,B,C & E virus, vaccinia virus, Reovirus and HIV. Introduction to Prions.

Unit IV: Vaccine its types (DNA vaccine bacterial vaccine recombinant vaccine and its development. Principles of vaccination--passive and active immunization. Immunization programmes & role in WHO.

Reference books

Genetics of viruses and bacteria- Hayes;

Microbiology-Davis

An introduction to viruses- Biswas & Biswas

Plant viruses- A D Singh

Genes---Benjamin Lewin

Learning outcome: Students will be able to understand the nature and pathogenicity of viruses in different living organisms and the means to control them.