

SARDAR PATEL UNIVERSITY
BT-301: Molecular Biology & Genetics
(One Paper-80 marks, 3-hours, 3 periods per week)
(Effective from June, 2008)

Unit-I:

Eukaryotic genome organization. Chromosome structure, types and banding (G,C,Q,R,T)- Nucleosome, chromatin, DNA binding proteins Histones & Non-histones DNA super coiling, linking number, Types of binding motifs – Zinc finger motifs, leucine zipper, helix loop helix, helix turn helix, Topoisomerase-types and function.

Unit-II

Replication in eukaryotes – problem associated with eukaryotic 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 RNA, t-RNA, r-RNA, modification of 5'-3' ends. Translation in eukaryote, post-translational modification, protein targeting, knock out genes.

Unit-IV

Basic microbial genetics: Introduction: conjugation, transformation, transduction, molecular mechanism and its significance. Recombination- site specific and homologous, Holliday model - role of rec genes and protein. Mobile genetic element prokaryotic and eukaryotic-Ac/DS, P-element Retrotransposon types examples and significance- LTR and non LTR containing retro transposons.

Unit-V

Mutation Definition, types-- gene mutation & chromosomal mutations, Mutagens-chemical and physical, molecular mechanism of mutation, Ames test, Isolation of mutants. Sex determination- different methods. Sex linked inheritance.

Unit-VI

Cell signaling—basic characteristics of cell signaling & significance, second messenger, G protein, coupled receptors, role of calcium as intracellular messenger, Receptor tyrosine kinases in signaling pathway. Apoptosis mechanism and significance. Regulation and control, mechanism of action.

Reference Books:

- Genes—Benjamin Lewin
- Molecular biology of the gene-Watson et al
- Molecular biology of the cell- Alberts et al
- Genetics- Gardner; Genetics of bacteria and viruses-William Hayes
- Principles of Biochemistry – Lehninger
- Cell & Molecular biology-P K Gupta
- Fundamentals of Biochemistry-Voet et al

SARDAR PATEL UNIVERSITY
BT-302: RECOMBINANT DNA TECHNOLOGY AND GENETIC ENGINEERING
(One Paper-80 marks, 3-hours, 3 periods per week)
(Effective from June, 2008)

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, Nucleic acid probes types and process. Precautions in handling DNA, RNA, corrosive and radioactive chemicals safety measures and regulation of recombinant DNA.

Unit-II

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

Reverse transcription and construction of c-DNA library & genomic DNA library. Recombinant selection and screening, immunochemical, nucleic acid hybridization colony and hybridization, southern and western blotting, Dot-Blot, differential screening. In situ hybridization FISH (radioactive and non radioactive detection of hybridization) Autoradiography.

Unit-IV

Electrophoretic separation of nucleic acids (Agarose gel & Poly acrylamide gel electrophoresis). PCR introduction types and application, site-directed mutagenesis, DNA sequencing—chain termination, chemical cleavage and automated. Foot printing types and application. In vitro transcription and in vitro translation, various systems and application. DNA fingerprinting-process and application.

Unit-V:

Genetic disorders (sickle cell anemia, thalassemia, cystic fibrosis, muscular dystrophy, Alzheimer) their molecular diagnosis and therapy. Production of cloned insulin, recombinant vaccine. Tissue engineering, Gene therapy.

Unit-VI:

Introduction to Bioinformatics Introduction to computers: Organization of computers, (Internet and its applications) Basic of windows & MS Office. 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)
Macromolecular 3D structure Databases: PDB, SCOP, CATH

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

SARDAR PATEL UNIVERSITY
BT-303: BIOMOLECULES AND BIOENERGETICS
(One Paper-80 marks, 3-hours, 3 periods per week)
(Effective from June, 2008)

Unit-I

Structure and function of plasma membrane. Chemical composition - structure and function of membrane protein and lipid membrane fluidity. The transport of substances across the membrane (active and passive transport), Cytoskeleton-structure and function of actin, microtubule, intermediate filament & motor proteins.

Unit-II

Enzymology—General characteristics and classification, definition with examples of holoenzymes, coenzymes, allosteric enzymes, apoenzymes, cofactors, activators, inhibitors units of enzyme activity, isoenzymes.. Overview of mechanism of enzyme action, active site, factors affecting enzyme activity. Enzyme kinetics—Derivation of Michelis and Menten equation and its modifications. Single substrate kinetics. Inhibition kinetics- competitive, non competitive and uncompetitive inhibition, mixed inhibition & substrate inhibition.

Unit-III

Glycolysis: central pathway of glucose metabolism, citric acid cycle and its regulation, pentose phosphate pathway, β -oxidation of fatty acids and ketogenesis, Deamination, transamination, decarboxylation of amino acids, urea cycle, overview of amino acid biosynthesis, nucleotide biosynthesis, (Denovo & Salvage pathway).

Unit-IV

Bioenergetics—Energy transformation and laws of thermodynamics, concept of internal energy, free energy, standard free energy, enthalpy and entropy. Hydrolysis of ATP and energy rich compounds. Redox potential and its significance. Oxidative phosphorylation and ATP synthesis, electron transport chain and chemiosmotic theory, binding change hypothesis.

Unit-V

Hormones- Introduction, chemical nature and types (peptides, steroids, amines and fatty acids) regulation of release of hormones mechanism of action of hormones. Introduction to pheromones. Brief overview of various endocrine gland & their secretion alongwith hormonal disorders.

Unit-VI

Enzyme immobilization and its significance. Biomarkers and their roles in diagnosis of various diseases (diabetes, cardiovascular disorder, cancer, kidney and liver diseases), inborn errors of metabolism. Free radicals and antioxidants – types and mechanism of action.

Reference books:

- Enzymology by Palmer; fundamentals of enzymology – Nicolas Price & Lewis Stevens
- Human physiology by Chatterjee and Chatterjee ; Human physiology by Tortora
- Biochemistry by Zubay; Biochemistry by Stryer ; Text book of biochemistry- Vasudevan & Shreekumari; Biochemistry -Lehninger

SARDAR PATEL UNIVERSITY
BT-304: Immunology & Virology
(One Paper-80 marks, 3-hours, 3 periods per week)
(Effective from June, 2008)

Unit-I

Antigen – Antibody interactions – Agglutination, precipitations, immunodiffusion, immuno electrophoresis, CFT, ELISA- Introduction, principle and types. Radio immuno assay, comparative account of RIA and ELISA. Primary and secondary lymphoid organs-lymph node, Bone marrow, spleen, thymus, MALT, and CALT organization and functions in brief.

Unit: II

B and T lymphocytes, Development, activation and differentiation of B and T cell, Gene rearrangement of light and heavy chains, Genetic basis of antibody diversity. Cell mediated immunity – NK cells mechanism of Action & importance cytokines introduction, types, brief over view of mechanism, and significance (role of cytokines in immune response).

Unit-III

Major Histocompatibility complex-structure, types, and functions, Transplantation – introduction, Graft rejection, hyper sensitivity Autoimmunity – Introduction, types and mechanism Immunodeficiency- Primary & secondary. (SCID) (AIDS).

Unit-IV:

History, origin and Modern classification of viruses (LHT system). Bacterial viruses-general structure morphology, location of nucleic acids, capsids, envelope. Assay of viruses -physical counts, Hemagglutination, plaque assay, pock method, end point method. Multiplication of bacterial viruses--lytic cycle -one step growth curve and molecular mechanism, lysogeny -establishment of lysogenic state, immunity regulation of lytic state and lysogenic state, significance of lysogeny.

Unit-V

Multiplication & movement of viruses in animals, tumor viruses-DNA & RNA tumor viruses. Role of viruses in oncogenesis. Cancer- Introduction, types, mechanism, concept of protooncogene and oncogenes. Tumor immunity, role of tumor specific antigen. HIV- structure of virus & multiplication. Introduction to prions.

Unit- VI

Plant viruses- structure, physical and chemical properties, infection, multiplication and movement of plant viruses. Symptoms of viral diseases in plants, transmission of plant diseases, control measures of viral diseases in plants. Isolation and detection of plant viruses. Introduction to viroids.

Reference books:

- Genetics of viruses and bacteria- Hayes; Microbiology-Davis
- Genes –Levin; Essential Immunology-Roit
- Immunology- Kuby;Molecular biology of the gene- Watson
- An introduction to viruses- Biswas & Biswas
- Plant viruses- A D Singh

SARDAR PATEL UNIVERSITY
BT-305: Environmental and Industrial Biotechnology
(One Paper-80 marks, 3-hours, 3 periods per week)
(Effective from June, 2008)

Unit-I

Biodiversity in India an introduction, types and significance steps to preserve biodiversity, Air pollution- types of pollutants and control measures of air pollution. Water pollution treatment of industrial and domestic waste (primary, secondary and tertiary treatment) (BOD, COD, TOC, colour, odour, DO, alkalinity, acidity presumptive and confirmative test for food and water analysis.

Unit-II

Biobleaching of copper iron gold and silver (types Heap Dump & in situ, mechanism of leaching. (Direct, Indirect and galvanic) significance, biodegradation of pesticide and other toxic chemicals, bioremediation, restoration of degraded land. Biosensors-principle and applications.

Unit-III

Fermentation (definition), batch and continuous fermentations, media (crude and synthetic), sterilization of media, screening (primary and secondary). Design of fermentor, Downstream processing- Filtration, centrifugation, solvent extraction, A brief introduction to bioreactors.

Unit-IV

Typical fermentation process (ethanol production , organic acid, Effect of aeration and agitation, Ccrit and KLa, pH and temperature on fermentation, Instrumentation for control of process (Temperature and pH electrodes), Strain improvement-isolation, characterization and modification.

Unit- V

Production of wine- red and white wine, sparkling wine, champagne and spoilage of wine. Production of beer, vinegar, penicillin and semisynthetic penicillin. Spoilage and preservation of food. Biosynthesis of penicillin and streptomycin- regulation of synthesis & mode of action. Strategies to develop hybrid antibiotics.

Unit-VI

Biotechnology: risks & ethics. Biosafety : Hazards of environmental engineering, biosafety guidelines and regulations, intellectual property rights (IPR) and protection (IPP) forms of protection patents (reading patents, patenting strategies) copy rights, trade secrets, trade marks, plant variety protection; world intellectual property organization (WIPO) general agreement of tariffs and trade (GATT) and trade related IPR (TRIPS) patenting of biological materials, patenting status in India.

Reference books:

- Industrial microbiology-Whitaker
- Industrial microbiology-A H Patel
- General microbiology- Frobisher
- Environmental pollution control engineering-C S Rao
- A text book of biotechnology – R C Dubey.

SARDAR PATEL UNIVERSITY
BT-306: Animal & Plant Biotechnology
(One Paper-80 marks, 3-hours, 3 periods per week)
(Effective from June, 2008)

Unit-I

Overview of animal cell culture: culture methods and process for stem cell, potential and application of stem cell. Transformation of animal cell – evolution of continuous cell line. Hybridoma technology introduction and steps for Hybridoma (HAT selection) production of monoclonal antibodies through hybridoma- vector method and engineered stem cell methods.

Unit-II

Genetic manipulation of animals- Introduction: Genetic manipulation of mammals. DNA transfer to vertebrates (Xenopus, fish, mice, sheep, goat) DNA transfer to invertebrates (flies), nuclear transfer technology (Dolly) process and applications. Animal developmental genes.

Unit-III

Advances and application of transgenic technology- Inducible expression system, strategy for gene inhibition, Transgenic technology for functional genomics. Human genome organization and project overview and significance. Construction of molecular map using different molecular marker system – RFLP, RAPD, AFLP, SNPs. Minisatellites.

Unit-IV

Micropropagation and its commercial application with suitable examples (Bamboo, coffee, banana, Artemisia, sugarcane, coconut and orchids). Somaclonal variation – Isolation, selection and characterization. Molecular basis of somaclonal variation and its applications. Production of bioactive compounds, hairy root culture, biotransformation and their significance.

Unit-V

Agricultural biotechnology- introduction, scope and national status. Development of disease resistant, insect resistant, herbicide resistant, stress resistant (drought, salt & frost) plants, improvement of nutritional value in plants.

Unit-VI

Transgenic plants, gene transfer methods in plants-physical, chemical & vector mediated, screening of transgenics, selectable & scorable markers. Biosafety, regulations of transgenic crops. A brief introduction to GM food, edible vaccine, plantibodies and molecular pharming.

Books:

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

SARDAR PATEL UNIVERSITY
PRACTICAL SYLLABUS
COURSE No. BT-307,308 & 309
(One Paper-70 marks,)
(Effective from June, 2008)

BT-307

1. Isolation of DNA from plant & fungi
2. Preparation of competent cells and transformation
3. Isolation of plasmid DNA
4. Separation of chromosomal and plasmid DNA by agarose gel electrophoresis
5. Restriction enzyme digestion of chromosomal DNA and plasmid DNA and their electrophoresis.
6. Isolation of RNA from animal cells and plant cells.
7. separation of RNA by electrophoresis.
8. Study of various stages of mitosis and meiosis in plant cells.
9. Effect of UV as a mutagen on pigment formation in *Serratia marcescens*.
10. Isolation of antibiotic resistant from soil by replica plating.
11. Demonstration of Southern blotting.
12. PCR amplification of given DNA.
13. RAPD analysis of plant DNA.

BT-308

1. Determination of K_m and V_{max} of amylase from *Bacillus*
2. Effect of temperature, pH, and incubation time on amylase activity.
3. Immobilization of whole cells by calcium alginate.
4. Immunodiffusion.
5. Widal test (slide test and tube test).
6. QPA (quantitative precipitin assay)
7. Bilirubin estimation.
8. Total count of WBC & RBC
9. Differential count of leucocytes.
10. Separation of protein by SDS PAGE.
11. DOT ELISA
12. Plaque assay

BT-309

1. Determination of BOD
2. Determination of COD
3. Production and estimation of penicillin
4. Production and estimation of gluconic acid
5. Production and estimation of alcohol
6. Bioassay of antibiotics by cup borer method
7. Anther culture for haploid production
8. Callus culture from leaf
9. Stem culture for micropropagation
10. Qualitative and quantitative analysis of food
11. Qualitative and quantitative analysis of water
12. Acidity and alkalinity of water.
13. Estimation of phosphate, sulphate and nitrate of polluted water