UNIT I

1. Nature of Gene: Evolution of gene concept, Chemical nature of gene, Split genes, Overlapping genes, Nested Genes, Gene families and pseudogenes
2. DNA Replication: General features of Chromosomal Replication. DNA Replication Machinery in Prokaryotes and its comparison with Eukaryotes
3. DNA damage, Repair Mechanisms, Repair Defects in Human diseases
4. Enzymology of DNA Replication: DNA Polymerases; Primases, Ligases, Helicases, Topoisomerases and Gyrases. Single stranded binding proteins. Regulation of DNA Replication; Inhibitors of DNA Replication

UNIT II

1. Transcription in prokaryotes, Structure and function of prokaryotic promoters
2. Structure and function of RNA Polymerase: Sigma factors- Types and functions
3. Control of transcriptional termination: Attenuation and antitermination
4. Operon concept, Structure and regulation of lactose, arabinose and tryptophan operons

UNIT III

1. Initiation of transcription in eukaryotes: RNA Polymerases Types and properties
2. Transcription factors- Types and properties; Enhancers- Structure and properties
3. Post-transcriptional modifications in eukaryotes
4. Splicing and RNA editing

UNIT IV

1. Genetic Code: Wobble hypothesis
2. Translation: stages of protein synthesis in prokaryotes and eukaryotes
3. Post-translational modification: Types and Significance
4. Translational proof reading

UNIT V

1. Regulation of gene expression in eukaryotes: cis- elements and trans factors
2. Chromatin organization and regulation of gene expression
3. DNA methylation and its role in gene regulation; Regulation of gene expression by hormones
4. Oncogenes and tumor suppressor genes
Practical Exercises

1. Isolation of Genomic DNA and restriction Digestion
2. Size fractionation of restricted DNA fragments by Agarose Gel Electrophoresis
3. Quantitations of DNA
4. Determination of Amax of purified DNA fragments
5. Determination of Tm of nucleic acid
6. Isolation of RNA
7. Fractionation of poly (A) RNA
8. In vitro transcription
9. In vitro translation
10. Metabolic labeling of proteins and immunoprecipitation
11. Protein-DNA interaction

Reference Books

1. Genes IX Benjamin Lewin
2. Molecular Biology, turner et al
3. Cell and Molecular Biology: Concepts and Experiments, Gerald Karp
4. Translational regulation in eukaryotes (2000), Carey and Smale
5. Translational control of Gene Expression (2000), Sonenberg et al
7. An Introduction to Genetic Analysis, Griffiths et al
8. Genome (1999), Brown
9. Concepts of Genetics, Klug and Cummings
10. Proteins, Creighton
11. Molecular Cell Biology, Lodish et al
12. Biochemistry and Molecular Biology of Plants (2000), Buchanan
13. Plant Biochemistry and Molecular Biology, Lea and Leegood
202 IMMUNOTECHNOLOGY

UNIT I

1. Immune response: Innate and adaptive immune system. Hematopoiesis and differentiation of hematopoietic cells by cytokines. Toll-like receptor-component of innate immune system; clonal selection theory
2. Anatomical organization of immune system: Primary & secondary lymphoid organs Ontogeny and phylogeny of lymphocytes, lymphocyte traffic
3. Cells of immune system: Mononuclear and granulocyte, antigen presenting cells Lymphocytes and their subsets. Haptanes: factor effecting immunogenicity; super antiges, Antigenicity and immunogenicity
4. Inflammation: its mediators and the process, immune response leading to an inflammatory reaction, role of anaphylaxis

UNIT II

1. Major histocompatibility systems: Organization of MHC with complex in Mouse and humans. Association of MHC with diseases
2. Antigen processing; role of MHC molecules in antigen presentation and co stimulatory signals
3. T-cell receptor complex, T-cell accessory membrane molecules, activation of T-cell, organization and arrangement of T-cell receptor genes
4. B-cell receptor complex, Immunoglobulin’s (Class and subclass): Molecular Structures, type and function. Antigenic determinants of immunoglobulins (isotype, allotype and idiootype)

UNIT III

1. Molecular mechanism of antibody diversity, Class switching
2. Antigen-Antibody infestation and affinity amusemen t
3. Monoclonal Antibodies and hybridoma technology and its application
4. Compliment system, components, Activation pathway, complement deficiency, role of complement system in immune responses opsonization (opsonin)

UNIT IV

1. Cytokines: Structures and function, cytokine related diseases and therapeutic application of cytokines
2. Cytotoxic T-Cell and their mechanism of action, NK cell and mechanism of target cell destruction, Antibody dependent cell mediated cytotoxicity, techniques of cell mediated immunity
3. Immunoregulation by antigens, Antibodies, immune complexes, MHC and cytokines.
4. Hypersensitivity and delayed Hypersensitivity
UNIT V

1. Mechanism of autoimmunity
2. Immune response during bacterial (tuberculosis), Parasitic (malaria) and viral (HIV) infection. congenital and acquired immunodeficiency; diagnosis and therapeutic approaches
3. Vaccines, Active and passive immunization, Recombinant-vector vaccines, DNA vaccines, synthetic peptide vaccines and sub-unit vaccines, Anti-idiotypic vaccines
4. Immunodiagnostics: development of immunodiagnostics kits for infectious and non infectious diseases with example. Precipitation techniques, Agglutination, ELISA, RIA, western Blotting and immuno-histochemical techniques (Avidin and Biotin system), Antibody engineering

Practical Exercises

1. Blood Film Preparation and identification of cells.
2. Lymphoid organs and their microscopic organization.
3. Immunization and production of polyclonal antibodies.
4. Double diffusion and Immuno-electrophoresis.
5. Radial immunodiffusion.
6. Purification of IgG from serum.
7. Separation of mononuclear cell by Ficoll-paque.
8. Con-A induced proliferation of thymocytes (by MTT Method).
9. Western blotting.
10. ELISA
11. Preparation of antibody-enzyme conjugates.

Reference Books

1. Immunology, Kubey, R.A. Goldsby, Thomas J.Kindt, Barbara, A. Osbarne (Freeman).
2. Immunology- A short Course, Eli Benamini, Richard Coico, Geoffrey Sunshine.
3. Immunology by Tizzard
5. Immunology by Roitt and others.
6. Immunology by Abbas
UNIT I

1. Enzyme: Historical aspects, classification and nomenclature, EC number
2. Mechanism of enzyme action and properties of enzymes as catalysts
3. Sub-cellular localization of enzymes
4. Methods of enzyme assay: continuous and sampling techniques, coupled enzyme assays, specific activity, turnover number

UNIT II

1. Enzyme purification: Objectives and strategy, methods of isolation and overview of purification techniques
2. Criteria of purity and tabulation of purification data, stable storage of enzymes
3. Characterization of purified enzyme,
4. Non-aqueous biocatalysis and enzyme engineering

UNIT III

1. Enzyme kinetics: Equilibrium and steady state theory, rate equation and determination of $K_m$ and $V_{max}$
2. Factors affecting rate of enzyme reaction: pH, temperature and pressure
3. Enzyme inhibition: reversible and irreversible inhibition, Applications of inhibitors
4. Rapid reaction techniques

UNIT IV

1. Isoenzymes and their physiological significance
2. Allosteric enzymes: co-operativity, MWC and KNF Models
3. Regulation of enzymes
4. Ribozymes and abzymes

UNIT V

1. Enzyme Immobilization: methods, applications and its effect on kinetic parameters
2. Enzyme Biosensor: Principle, components of biosensor, types
3. Development of enzyme biosensors
4. Applications of biosensor for clinical diagnosis
Practical Exercises

1. Urease estimation by tritritmetric method
2. Urease estimation by colorimetric method
3. Acid phosphatase estimation
4. Alkaline phosphatase estimation
5. Determination of optimum time, optimum temperature & optimum pH
6. Determination of Km value
7. Acetylcholine esterase/pseudocholinesterase estimation
8. Enzyme purification

Reference Books

1. The nature of Enzymology by R.L. Foster
2. Enzymes by Dixon and Webb
3. Fundamentals of Enzymology by Price and Stevens
4. Enzyme Catalysis and Regulation by Hammes
5. Enzyme Reaction Mechanisms by Walsch
6. The Enzymes vol I and II by Boyer
7. Enzyme Structure and Mechanism by Alan Fersht
8. Enzyme Assays: A Practical Approach by Eisenthal and Danson
204. PART A: ENVIRONMENTAL BIOTECHNOLOGY

UNIT I

1. Environment pollution: types, methods for measurement of pollution
2. Solid waste treatment: Composting process, Vermicomposting and its advantages
3. Biomedical waste and its management
4. Xenobiotics and its degradation

UNIT II

1. Microbial waste treatments: aerobic and anaerobic processes
2. An Integrated pest management- Biopesticides: types and impact on environment
3. Bioremediation: In situ and Ex situ techniques advantages and applications of genetically engineered microbes (GEM) in bioremediation.
4. Phytoremediation: Types and its applications, Bioindicators, GMOs and assessment of environmental impact and monitoring

Practical Exercises

1. Determination of dissolved oxygen concentration of water sample
2. Determination of biological oxygen demand (BOD) of sewage sample
3. Determination of Chemical oxygen demand (COD) of sewage sample
4. Isolation of xenobiotic degrading bacteria by selective enrichment technique
5. Test for the degradation of aromatic hydrocarbons by bacteria
6. Survey of degradative plasmids in microbes growing in polluted environment
7. Study on biogenic methane production in different habitats

Reference Books

2. Environmental chemistry. A.K.De, Wiley Eastern Ltd., New Delhi
3. Introduction to Biodeterioration. D.Allsopp and Seal, ELBS/ Edward Arnold
4. Environmental Biotechnologies and Cleaner Bioprocess by Eugenia J Olguin et al
5. Environmental Science: Physical Principles and applications by Egbert Boeker et al
UNIT III
1. Animal cell culture: Organization of animal cell and tissue culture laboratory
2. Culture Medium: types, functions of different constituents of media, role of CO₂
3. Primary and established cell line cultures
4. Measurement of growth parameters

UNIT IV
1. Scaling up of animal cell culture, Cell synchronization
2. Cell cloning and micromanipulation
3. Measurement of cell viability, methods of separation of cell types
4. Stem cell cultures, embryonic stem cells and their applications

UNIT V
1. Commercial applications of cell culture: cytotoxicity and diagnostic tests
2. Cell culture based vaccines
3. 3-D animal cell culture
4. Transgenic animals

Practical Exercises: Part B
1. Preparation of tissue culture medium and membrane filtration
2. Preparation of single cell suspension from spleen and thymus
3. Cell counting and viability
4. Macrophage monolayer from PEC and measurement of phagocytic activity
5. Cell fusion with PEG

Reference Books
1. Culture of Animal Cells by RI Freshney
3. Animal Cell Culture Techniques by Ed. Martin Clynes