

**OBJECTIVES:** To enable the students to –

- Acquainted with concepts of basic immunology
- Awake on vaccines and their active potential
- Learn enzymes used in recombinant DNA technology & cloning vectors
- Know various gene transfer techniques and cloning strategies
- Optimize the biological data by various software tools

**COURSE OUTCOMES: Students will**

- **CO1:** Be acquainted with the basics of immune system & immune response.
- **CO2:** Familiarize on vaccine strategies and well versed with concepts of immunodiagnostics.
- **CO3:** Accustomed with the tools and techniques of genetic engineering molecular cloning and expression vectors.
- **CO4:** Be acknowledged with various applications of genetic engineering.
- **CO5:** Be proficient in analyzing the biological data by various software tools.

#### **UNIT-I: CONCEPTS, CELLS AND ORGANS OF THE IMMUNE SYSTEM**

1. Terminology, antigen, hapten, antibody (types), antigenicity, immunogenicity and types of immunity: Innate and adaptive immunity.
2. Haematopoiesis, organs, tissues, cells and mediators of the immune system (primary and secondary lymphoid organs, lymphocytes and cytokines).
3. Introduction to complement components, MHC.
4. Basic concepts of humoral and cell-mediated immune response.

#### **UNIT-II: VACCINOLOGY AND CLINICAL IMMUNOLOGY**

1. Live, killed, attenuated, subunit and recombinant vaccines.
2. Role and properties of adjuvants.
3. Hybridoma technology, monoclonal antibodies and their application in immunodiagnostics.
4. Antigen and antibody interactions - precipitation, agglutination, immune diffusion and ELISA.
5. Introduction to hypersensitivity and autoimmunity.

#### **UNIT-III: TOOLS AND TECHNIQUES OF rDNA TECHNOLOGY**

1. Introduction to rDNA technology, steps involved in cloning.
2. Tools of genetic engineering: Cloning vectors – Plasmids & Cosmids & Enzymes – restriction endonucleases and DNA Ligase, Hosts – bacteria and yeast).
3. Principles and application of PCR.
4. Southern, Northern and Western Blotting.
5. DNA sequencing methods: Maxam-Gilbert, Sanger and Site-directed Mutagenesis.

## **UNIT – IV: CLONING STRATEGIES AND APPLICATIONS OF rDNA TECHNOLOGY**

1. cDNA library & construction
2. Methods of gene transfer techniques.
3. Isolation and screening of recombinant clones.
4. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting).

## **UNIT V: BIOINFORMATICS**

1. Databases (PubMed, NCBI, EMBL and ExPASy)
2. Nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction.
3. Introduction to Omics (proteomics, genomics and transcriptomics).
4. Introduction to nanotechnology.

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