

## **B.Sc., Biotechnology: Choice based credit system**

### **B.Sc., -III- Semester W.E.F. 2020-21**

#### **BT-301: Immunology and rDNA technology**

**Course Objectives:** To acquaint students with concepts of immunology and recombinant DNA technology. This course is aimed to give an understanding of the basics of immunology dealing cells and organs of the immune system, types of immune responses, antigen-antibody interactions, vaccines and tools, techniques and strategies and applications of genetic engineering.

#### **Unit- I –Concepts, Cells and Organs of the Immune System**

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

#### **Unit-II-Vaccinology and Clinical Immunology**

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

#### **Unit-III –Introduction, Tools and Techniques of rDNA Technology**

Introduction to rDNA technology, steps involved in cloning, tools of genetic engineering (Genes, Cloning vectors - plasmids and cosmids, Enzymes – restriction endonucleases and DNA Ligase, Hosts – bacteria and yeast). Principles and application of PCR. Southern, Northern and Western Blotting. Introduction to DNA sequencing (Sanger Sequencing) and Site-directed Mutagenesis.

#### **Unit-IV-Cloning Strategies and Application of rDNA Technology**

cDNA library, construction, methods of transformation, recombinant selection and screening methods. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting).

#### **Unit-V-Bioinformatics**

Databases (PubMed, NCBI, EMBL and ExPASy), nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction. Introduction to omics (proteomics, genomics and transcriptomics). Introduction to nanotechnology.

### **List of Practicals:-**

1. Determination of Blood Groups
2. Pregnancy test
3. Widal test
4. Ocuteroloney immunodiffusion
5. Radial immune diffusion
6. ELISA
7. Production of antibodies (theory exercise)
8. Bleeding, separation of serum and storage
9. Lymphoid organs (theory exercise)
10. Isolation of plasmid DNA (alkaline lysis method)
11. Analysis of plasmid DNA by Agarose gel electrophoresis
12. Southern blotting (theory exercise)
13. PCR Amplification (theory exercise)

### **Textbooks for Immunology and rDNA technology**

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012),  
Freeman and Co., NY
2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and  
Shubhangi Sontakke, University Press, India
3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt,  
Mosby, USA.
4. Immuno diagnostics, 1996, By S.C. Rastogi, Publ: New Age
5. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House
6. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
7. Principles of Gene Manipulation - 7<sup>th</sup> edition, 2006, By R.W. Old & S.B. Primrose, Publ:  
Blackwell
8. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
9. Molecular Biotechnology - 4<sup>th</sup> edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
10. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
11. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
12. Molecular Biology - 4<sup>th</sup> Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house  
New York, Delhi

13. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
14. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
15. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
16. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7<sup>th</sup>edition. Blackwell Publishing, Oxford, U.K.
17. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rdedition. Cold Spring Harbor Laboratory Press.
18. Introduction to Bioinformatics – 2007, By V. Kotheekar
19. Introduction to Bioinformatics – 2013, By Arthur M. Lesk
20. Bioinformatics: 2001, Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press
21. Biological Sequence Analysis: 1<sup>st</sup> Edition, 1998, Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press
22. Bioinformatics: 2004, A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley-Interscience
23. Bioinformatics tools and Resources – free online tools, software packages, Bioinformatics books and Journals, Bioinformatics web-portals