MIM 5521 **Molecular Biotechnology** **6Hrs/5Cr**

This course comprises various techniques for studying the gene, manipulation of gene sequences, cloning strategies and their applications. Special emphasis is given to basic techniques used in genetic engineering such as different vectors, manipulative enzymes, library construction and methods of gene of transfer.The course also covers important topics such as production of transgenic plants& animals, gene therapy and their applications, patenting, rDNA regulations and ethical concerns.

Specific Learning Outcome:

Upon successful completion of this course, students will be able to

- understand the tools and techniques used to extract, quantify, and synthesis nucleic acids
- learn the various enzymes, vectors and cloning techniques to manipulate nucleic acids
- comprehend types of systems used to study the expression of recombinant gene
- know the diagnostic methods that uses molecular manipulation of nucleic acids
- be aware of the ethical, legal and social implications of modern biotechnology
- explore advanced fields like transgenics, genomics, proteomics and metagenomics

I. **Introduction to rDNA technology:** Nucleic acids – manipulation, chemical synthesis, isolation, quantification, labelling, gel electrophoresis;Restriction Endonucleases - types, other enzymes,Cloning vectors - properties, types – plasmids, bacteriophage, hybrid, artificial chromosomes, expression vectors- Plasmid Cloning Vectors, Phage vectors- λ &M13, Cosmids, Phagemids and BAC; Cloning strategies - Construction of genomic and cDNA library, Ligation strategies; chromosome walking, subtractive hybridization, gene transformation in bacteria- selection of recombinants; PCR – types, DNA sequencing techniques.

II. **Manipulation of gene expression:** Strong and Regulatable Promoters, Fusion Proteins, Translation Expression Vectors; Eukaryotic Expression Systems Heterologous Protein Production, Fungus-Based Expression Systems,Baculo virus–Insect Cell Expression Systems, Mammalian Cell Expression Systems; Directed Mutagenesis procedures and Protein Engineering.

III. **Molecular diagnostic methods:** Molecular diagnostics – biofluorescent& bioluminescent systems, nucleic acid diagnostic systems- antisense RNA, ribozymes, chimeric RNA-DNA molecules, aptamers, SiRNAs, antibody genes and nucleic acid delivery- molecular diagnosis of genetic disease, RFLP, RAPD as tools of diagnosis

IV. **Transgenics:** Transgenic Plants – Ti plasmid mediated and physical methods of gene transfer, Chloroplast engineering, gene targeting. Development of pathogen (bacteria and fungus), drought, insecticide and stress resistance plants. Transgenic Animals – methods, applications, Transgenic mice, livestock, poultry and fish.

V. **Applications of molecular biotechnology:** Gene therapy – types and applications. Approaches for the study of Genomics, Proteomics, metagenomics and their applications. DNA chips and its applications. DNA microarray technology - Protein expression profiling and serial analysis of gene expression. Ethical, legal and social implications of modern biotechnology.

Textbooks:

1. Glick BR and Pasternak JJ. (2017). *Molecular Biotechnology – Principles and Applications of Recombinant DNA Technology*, Panima Publishing Co, New Delhi.
2. Brown TA. (2015).*Gene cloning and DNA analysis – an introduction*. 5th Ed. Blackwell, Oxford.

References:

1. Clark, D. P., &Pazdernik, N. J. (2013). *Molecular biology*. 2nd Ed. Elsevier.
2. Clark, D. P., &Pazdernik, N. J. (2015). *Biotechnology*. Newnes.
3. Satyananrayana U. (2013).*Biotechnology*.1st Ed, Books and Allied (P) Ltd, Kolkata.
4. Desmond ST and Nicholl. (2008).*An Introduction to Genetic Engineering*. Cambridge University Press, Oxford.
5. Watson JD, (2007).*Recombinant DNA*. 2nd Ed. Scientific American Books, WH Freeman and Co, New York.
6. Primrose SB and Twyman RM. (2013).*Principles of Gene Manipulation and Genomics*. 7th Ed. Blackwell Scientific Publications, New York.