

**Course Code: BCH 421**

**Course Title: Molecular Biology and Biotechnology**

**Credit Hours: 3(2+1)    Full Marks : 75    Theory: 50    Practical: 25**

**Objective**

Upon completion of the course, students will be able to understand the fundamentals of molecular biology and DNA technology, and its use in animal biotechnology and disease diagnosis.

**Syllabus**

Structure and properties of nucleic acids, recombinant DNA technology, biotechnological applications in animal improvement, nutritional biotechnology, animal tissue culture, molecular diagnosis, fermentation process, regulatory issues in biotechnology, bioinformatics and modern vaccine. Genetic diseases and gene therapy.

**Course Breakdown**

**Theory**

| S.N. | Topic                                                                                                                                     | No. of Lectures |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1    | Overview of DNA and RNA structure, DNA replication and transcription, RNA processing, Translation and genetic code. DNA damage and repair | 1               |
| 2    | Regulation and expression of gene                                                                                                         | 1               |
| 3    | Chromosomal aberrations and gene mutation                                                                                                 | 1               |
| 4    | Gene cloning, vectors and expression vectors.                                                                                             | 1               |
| 5    | Transformation and transfection                                                                                                           | 1               |
| 6    | Real time Polymerase chain reaction (PCR)                                                                                                 | 1               |
| 7    | Construction of genomic library and cDNA library                                                                                          | 1               |
| 8    | DNA sequencing.                                                                                                                           | 1               |
| 9    | Principles of transfer of nucleic acids and proteins (Southern, Northern and Western blotting)                                            | 1               |
| 10   | Nucleic acid hybridization                                                                                                                | 1               |
| 11   | DNA probes and DNA fingerprinting                                                                                                         | 1               |

|              |                                                                                |           |
|--------------|--------------------------------------------------------------------------------|-----------|
| 12           | Restriction fragment length polymorphisms and related DNA-based approaches     | 1         |
| 13           | DNA microarray technology                                                      | 1         |
| 14           | Proteomics                                                                     | 1         |
| 15           | Embryo biotechniques, in-vivo and in- vitro embryo production and preservation | 1         |
| 16           | Sexing, micromanipulation and cloning                                          | 1         |
| 17           | Transgenic animal and biopharming                                              | 1         |
| 18           | Mapping of genome and genome sequencing                                        | 1         |
| 19           | Marker assisted selection                                                      | 1         |
| 20           | Gene banking                                                                   | 1         |
| 21           | Bioconversion of lignocellulose                                                | 1         |
| 22           | Genetic manipulation of microbes for improved feed utilization and health      | 1         |
| 23           | Animal tissue culture, transformation and cell lines                           | 1         |
| 24           | Tumor markers and acute phase proteins and DNA probes                          | 1         |
| 25           | Hybridoma and monoclonal antibodies                                            | 1         |
| 26           | Gene deletion vaccines-bacteria and subunit recombinant                        | 1         |
| 27           | Marker vaccines, companion diagnostic tests and recombinant vectored vaccines  | 1         |
| 28           | Fermentation process and technologies for milk, meat and leather               | 1         |
| 29           | Ethics and regulatory issues in biotechnology, IPR and Bioinformatics          | 1         |
| 30           | Genetic diseases & Gene therapy                                                | 1         |
| <b>Total</b> |                                                                                | <b>30</b> |

### Practical

| S.N. | Topic                                                           | No. of Practical |
|------|-----------------------------------------------------------------|------------------|
| 1    | Tumor markers and its detection in tissue affected by tumors    | 1                |
| 2    | Antibody detection by Competitive ELISA (C-ELISA)               | 1                |
| 3    | RNA isolation.                                                  | 1                |
| 4    | Demonstration of real time PCR-techniques for disease diagnosis | 3                |

|              |                                                                        |           |
|--------------|------------------------------------------------------------------------|-----------|
| 5            | Expression analysis of gene by Northern and Western analysis.          | 1         |
| 6            | Detection of protein by Immunohistochemistry and Immunoblotting        | 2         |
| 7            | Embryo transfer techniques                                             | 2         |
| 8            | Use of Multimedia and audio-visual aids for molecular biology aspects. | 2         |
| 9            | Tissue culture techniques                                              | 2         |
| <b>Total</b> |                                                                        | <b>15</b> |

## References

- Karp, G and G. John... 1999. Cell and molecular Biology, Concepts and experiments latest edition). Wiley and Sons.
- Jenkins, N. 1999. Methods in Biotechnology. Animal Cell Biotechnology – Methods & Protocols. Published by Human Press Inc., New Jersey.
- Malacinski and J. Freifelder. 1996. Essentials of molecular Biology (latest edition). Bartlett Publishers.
- Srivastava S., P. S. Srivastava & B. N. Tiwary. 1996. Trends in Molecular biology and Biotechnology. CBS Publications & Distributors, New Delhi.
- William H. E. & D. C. Elliott. 1997. Biochemistry and Molecular Biology. Oxford University press, Oxford.