BS 8th Semester

Semester – VIII		
Course Code	**Subjects**	**Credit Hours**
Bot-410 & 411	Molecular Genetics	2 + 1
Bot-412 & 413	Plant Pathology	2 + 1
Bot-414 & 415	Plant Nutrition and Soil Fertility	2 + 1
Bot-416 & 4117	Advances in Plant Physiology	2 + 1
Bot-418	Elective Paper/Research	2 + 1
		3 + 0
Semester Credit Hours		**15**

Bot-410 & 411 MOLECULAR GENETICS Credit Hours:3(2+1)

THEORY

Introduction of the Course:

This course includes concepts regarding Recombinant DNA and its applications, gene expression, mechanisms of genetic changes including mutation, recombination and transposable elements, genome projects.

Course Objectives:

1. To enable the students to understand the structural and functional basis of genes and gene expression, DNA and genetic changes including mutation, recombination and transposable elements.
2. To enable the students to understand various DNA manipulations at the molecular level.

Contents:

1. **Recombinant DNA:** Recombinant DNA Technology – Introduction, Basic Techniques, PCR, Restriction enzymes, DNA sequencing, plasmids and bacteriophages as tools, the formation of recombinant DNA, Restriction and modification system, recombinant DNA and social responsibility, Site directed mutagenesis.
2. **Application of Recombinant DNA**: Applications of recombinant DNA technology using prokaryotes, recombinant DNA technology in eukaryotes - An overview, transgenic yeast, transgenic plants, transgenic animals, gene therapy, genetically modified organisms and apprehensions.
3. **Control of Gene Expression**: Discovery of the *lac* system: negative control, catabolite repression of the *lac* operon: positive control, transcription: gene regulation in eukaryotes - an overview.
4. **RNA Processing**: Exons & introns, splicing, Self-splicing introns, RNA editing, Transsplicing, RNA interference, siRNAs, miRNAs, ncRNAs.
5. **Genetic Change-Gene Mutation**: The molecular basis of gene mutations, spontaneous mutations, induced mutations, mutagens and carcinogens, biological repair mechanisms.
6. **Genetic Change-Recombination**: General homologous recombination, the holiday model, enzymatic mechanism of recombination, site-specific recombination, recombination and chromosomal rearrangements.

7. **Genetic Change - Transposable Genetic Elements**: Insertion sequences, transposons, review of transposable elements in prokaryotes, controlling elements in maize.
8. **Human Genome Project**: Strategies and application, achievement and future prospects.
9. **Plant Genome Projects**: Arabidopsis, achievement and future prospects.
10. **Bioinformatics:** Application of computational tests to the analysis of genome and their gene products.
11. **Bioethics**: Moral, Religious and ethical concerns **Practicals:**

1. Problems related to the theory, Isolation and separation of DNA and protein on Gel electrophoresis.
2. Quantitative separation of macromolecules (Plasmid DNA, plant DNA, Protein) using electrophoresis.
3. DNA Amplification by PCR

Teaching-learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop **Learning Outcome:**

1. Students are expected to get themselves familiarized with the molecular/macromolecular organization of plant cells and DNA in general.
2. They should be able to understand almost infinite possibilities of structural organization, molecular backbones and the myriad roles or functions they can take or perform.
4. Students should be able to understand the basic concepts with regard to DNA Amplification by PCR.

Recommended Readings:

1. Brown, T. A. (2002). *Genomes*, Bios Scientific Publishers Ltd.
2. Gelvin, S. B. (2000). *Plant Molecular Biology Manual*. Kluwer Academic Publishers.
3. Griffiths, A. J. F., Wessler, S. R., Lewontin, R. C., Gelbart, W. M., Suzuki, D. T. and Miller, J. H. (2010). *Introduction to Genetic Analysis*, W.H. Freeman and Company. (11^{th} Edition)
4. Hartt, D. L. and Jones, E. W. (2005). *Genetics, Analysis of Gene and Genomes*. Jones and Bartlett Publishers, Sudbury, USA
5. Ignacimuthu, S. (2005) *Basic Bioinformatics*, Narosa Publishing House, India.
6. Lwein, B. (2004). *Gene VIII*, Pearson Education Int.
7. Miglani (2003) Advanced *Genetics*, Narosa Publishing House, India.
8. Primrose, S. B., Twyman, R. M. and Old, R. W. (2004). *Principles of Gene Manipulation*, an Introduction to Genetic Engineering, Blackwell Scientific Publications.
9. Snyder, L. and Champness, W. (2003). *Molecular Genetics of Bacteria*, ASM Press.
10. Trun, N. and Trempy, J. (2004). Fundamental *Bacterial Genetics*, Blackwell Publishing House.
11. Wilson, J. and Hunt, T. (2004). *Molecular Biology of the cell* – the problems book, Garland publishing Inc.
12. Winnacker, E. L. (2003). *From Gene to Clones – Introduction to Gene Technology*, Panima Publishing Corporation, New Delhi.

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