Programme	BS	Course Code	BOT-317	Credit Hours	3
Course Title	**Molecular Genetics (Theory)**				

Introduction

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

Learning Outcomes

On completion of the course, the students will be:

- nable the students to understand the structural and functional basis of genes and gene expression, DNA and genetic changes including mutation, recombination and transposable elements.
- able the students to understand various DNA manipulations at the molecular level.Students are expected to get themselves familiarized with the molecular/macromolecular organization of genetic material.
- able to understand the possibilities of structural organization and molecular backbones regarding DNA.
- able to understand the basic concepts with reference to DNA amplification and other molecular techniques.

Course Contents

- Recombinant DNA: Recombinant DNA Technology – Introduction, Basic Techniques, PCR. Restriction enzymes, DNA sequencing, plasmids and bacteriophages as a tool for genetic manipulation. The formation of recombinant DNA, Restriction and modification system, recombinant DNA and social responsibility
- Principles of Recombinant DNA technology: Role of Recombinant DNA Technology in economic development. Site directed mutagenesis.
- Application of Recombinant DNA technology using prokaryotes in plants and animals; Recombinant DNA technology in eukaryotes - An overview, transgenic yeast, transgenic plants, Transgenic animals.
- Gene therapy, Genetically modified organisms and apprehensions
- Control of Gene Expression: Discovery of the *lac* system: Negative control system. Lac Operon. Catabolite repression of the *lac* operon: Positive control. Transcription: Gene regulation in eukaryotes - An overview.
- RNA Processing: Exons & introns, splicing, Self-splicing introns, RNA editing, Trans-splicing, RNA interference, siRNAs, miRNAs, ncRNAs.
- Genetic Change-Gene Mutation: The molecular basis of gene mutations, spontaneous mutations. Induced mutations, Mutagens and carcinogens. Biological repair mechanisms.
- Genetic Change-Recombination: General homologous recombination, the holiday model, Enzymatic mechanism of recombination. Site-specific recombination, recombination regarding chromosomal rearrangements.
- Genetic Change - Transposable Genetic Elements: Insertion sequences, transposons. Transposable elements in prokaryotes, Controlling elements in maize.
- Molecular markers: Introduction, Dominant, Co-dominant markers system, RFLP, AFLP, SNPs.
- Introduction to Human and Plant Genome Project.
- CRISPR-Cas – An Advance technology for Gene Editing.
- Bioinformatics - Applications in genetics and genome analysis.
- Bioethics: Moral, Religious and ethical concerns