Course title: Molecular Genetics for Plant Functional Genomics: Principles and Practice			
Course code: BBP 148	**No. of credits:** 3	**L-T-P:** 22-23-0	**Learning hours:** 45
Pre-requisite course code and title (if any): None			
Department: Department of Biotechnology			
Course coordinator(s): Prof. Anandita Singh		**Course instructor(s):** Prof. Anandita Singh / Prof. Shashi Bhushan Tripathi	
Contact details: asingh@terisas.ac.in / shashi.tripathi@terisas.ac.in			
Course type: Elective		**Course offered in:** Semester 3	

Course description:

Transformative technological solutions emerging from plant biotechnology can tackle sustainability challenges in varied sectors including agriculture, energy, and environment. Crop genomics offers exciting possibilities to enhance production of nutritious food to feed the future world. Bio-synthetic potential of plants is being exploited to harvest solar energy for bio-fuel production and achieving CO_2 sequestration. Nonetheless, true potential of plant sciences is required to be harnessed by way of systematic, large-scale functional studies of candidate genes and intergenic regions at genome-wide level. The multi-disciplinary approach of functional genomics aims to unravel the complex relationship between genotype and phenotype. Functional genomics also aims to describe constituents of biological systems and how these interact to manifest traits.

Molecular genetics lies at the heart of functional genomics. The phenotype centric view derived from experimental validation is in sharp contrast with hypothesis driven OMICS and bioinformatics approaches. Analysis of mutant phenotypes, combined with forward mapping strategies are cornerstones for molecular genetics research. Integration of contemporary NGS driven, genome-wide tools, precision phenotyping and genome editing have accelerated gene discovery and functional characterization of genes. Advance statistical models and ML methods have been deployed to fast-track production of superior crops.

This advance level course has been designed to impart an in-depth knowledge on concepts and methodological repertoire of molecular genetics for the purpose of gene discovery and characterization. A basic understanding on principles of molecular biology, genetics and biochemistry is required to fully comprehend the topics covered in this course. Students will be briefly oriented to technologies and various online resources for functional genomics research. However, insights on genomics, genotyping methods, epi-genomics, transcriptomics, proteomics and metabolomics, are to be integrated from other courses taught in the programme. Relevant topics implied in molecular genetics are assembled in five modules given below. Case studies will be used to illustrate power of new technologies in decoding genomes and pangenomes, dissecting genetic architecture of traits, discovering novel alleles and translation of basic knowledge for design of low-input, high-yielding, climate resilient crop varieties.

Course objectives:

1. Building perspectives on integrative approaches of "Functional Genomics"
2. Promoting an understanding on genesis and scope of "Molecular Genetics"
3. Creating an in-depth understanding on forward and reverse genetics-based approaches for dissecting genotype-phenotype relationship
4. Introducing methodological repertoire of forward and reverse genetics
5. Inculcating an appreciation for power of molecular genetics and genomics in unravelling biological function, processes, and phenomena for crop improvement