

## **5. Plant Genetic Engineering workshop**

### **Course Details**

#### **Lecture 1: Plant hormones: Biosynthesis and Function**

- Functions of plant hormones
- Auxin: The growth hormone
- Cytokinin: Regulators of Cell division and its role in plant development
- Gibberelins: Regulators of plant height
- Ethylene: The Gaseous hormone and its uses

#### **Lecture 2: Plant tissue culture-overview, requirements and detailed workflow**

- Plant tissue culture-overview
- Basic structure and growth of plant
- Conventional plant breeding and plant tissue culture
- Plant tissue culture requirements
  - Media
  - Physical conditions
- Types of plant tissue culture
  - Callus culture
  - Cell culture
- Applications of plant tissue culture

#### **Lecture 3: Transgenic plants-overview and importance**

- Introduction to Transgenic plants
- Gene constructs
- Vectors for the production of transgenic plants
- Transformation techniques
- Integration and Inheritance of transgenes
- Screening and selection of transformants
- Transgene stability
- Generation and maintenance of transgenic plants
- Future of transgenic plants

#### **Lecture 4: Trait Improvement of plants**

- Transgenics to drought tolerance, salt tolerance and freeze tolerance
- Insect resistance with cry proteins and non Bt proteins
- Improving the nutritional quality and functional properties of seed proteins carotenoids and flavonoids
- Improvement of shelf life of fruits and flowers
- Herbicide resistance in plants
- Improving plant photosynthesis and growth
- Nitrogen fixing genes and nod genes- structure, function and role in nodulation
- Hydrogen metabolism and genetic engineering of hydrogenase genes
- Development of transgenics for phytoremediation

## **Lecture 5: Plant Genome Analysis:**

Importance of mapping-genetical and physical maps

- Breeding requirements for maps
- Molecular markers
  - Isozymes
  - RFLP
  - RAPD
  - SSR
  - ISSR
  - AFLP
  - SNP
- Marker assisted breeding for crop improvement
- T-DNA and transposon tagging
- TILLING in Plants

## **Lecture 6: Sensory photobiology and advances**

- Structure, function and mechanisms of action of
  - Phytochromes
  - Cryptochromes
  - Phototropins
- Stomatal movement
- Photoperiodism
- Biological clocks

## **Lecture 7: Plant Genes and Gene silencing**

- Plant nuclear genes
- Plastid genes and mitochondrial genes
- preparation of plant cDNA and genomic libraries in vector systems
- RNA silencing
- miRNA-concept and overview
- siRNA-concept and overview
- RNA silencing for plant functional genomics
- *In silico* analysis and assignment of gene function

## **Chapter 8: Plant metabolic engineering- overview and importance**

- Introduction on plant metabolic engineering
- Biosynthesis metabolic pathway
- Mechanisms of gene expression regulation
- Tissue culture for Metabolic engineering
- Bioconversion

- hairy root culture
- cell suspension culture
- Changing the nutritional profile of plants
- Molecular (Protein) farming
- Biopolymer
- Bioenergy from plant