

Ph.D. Programme

Course No.	Title of the Course	Credit
1st Semester		
ABT 701	Advances in Plant Molecular Biology	3+0
ABT 702	Advances in Genetic Engineering	3+0
ABT 703	Advances in Microbial Biotechnology	3+0
2nd Semester		
ABT 751	Advances in Crop Biotechnology	3+0
ABT 752	Advances in Functional Genomics and Proteomics	2+0
ABT 799	Seminar-I	1+0
3rd Semester		
ABT 801	Commercial Plant Tissue Culture	2+0
ABT 802	Advances in Animal Biotechnology	2+0
ABT 849	Seminar-II	1+0
4th Semester		
	Nil	
5th Semester		
	Nil	
6th Semester		
ABT 999	Seminar-III	1+0

ABT 701: Advances in Plant Molecular Biology

3+0

UNIT I: Arabidopsis in molecular biology, Forward and Reverse Genetic Approaches, Transcriptional and post-transcriptional regulation of gene expression, isolation of promoters and other regulatory elements.

UNIT II: RNA interference, Transcriptional gene silencing, Transcript and protein analysis, use of transcript profiling to study biological systems.

UNIT III: Hormone regulatory pathways: ethylene, cytokinin, auxin and ABA, SA and JA; ABC model of floral development; Molecular basis of self incompatibility; Regulation of flowering: photoperiod, vernalization, circadian rhythms.

UNIT IV: Molecular biology of abiotic stress responses: cold, high temperature, submergence, salinity and drought; Molecular biology of plant-pathogen interactions, molecular biology of *Agrobacterium* infection; Molecular biology of *Rhizobium* infection (molecular mechanisms in symbiosis); Programmed cell death in development and defense.

ABT 702: Advances in Genetic Engineering

3+0

UNIT I: General overview of transgenic plants; Case studies: Genetic engineering of herbicide resistance, Transgenic plants resistant to insects/pests, Genetic engineering of abiotic stress tolerance, Engineering food crops for quality, Genetically engineered pollination control, Induction of male sterility in plants.

UNIT II: Molecular farming of plants for applications in veterinary and human medicine systems: Boosting heterologous protein production in transgenics, Rapid production of specific vaccines, High-yield production of therapeutic proteins in chloroplasts.

UNIT III: Recent developments in plant transformation strategies; Role of antisense and RNAi-based gene silencing in crop improvement; Regulated and tissue-specific expression of transgenes for crop improvement; Gene stacking; Pathway engineering; Marker-free transgenic development strategies; High throughput phenotyping of transgenic plants.

UNIT IV: Field studies with transgenic crops; Environmental issues associated with transgenic crops; Food and feed safety issues associated with transgenic crops; Risk assessment of transgenic food crops.

ABT 703: Advances in Microbial Biotechnology

3+0

UNIT I: Fermentative metabolism and development of bioprocessing technology, processing and production of recombinant products; isolation, preservation and improvement of industrially important microorganisms.

UNIT II: Immobilization of enzymes and cells; Batch, plug flow and chemostate cultures; Computer simulations; Fed-batch and mixed cultures; Scale-up principles; Downstream processing etc.

UNIT III: Current advances in production of antibiotics, vaccines, and biocides; Steroid transformation; Bioreactors; Bioprocess engineering; Production of non-microbial origin products by genetically engineered microorganisms.

UNIT IV: Concept of probiotics and applications of new tools of biotechnology for quality feed/food production; Microorganisms and proteins used in probiotics; Lactic acid bacteria as live vaccines; Factors affecting delignification; Bioconversion of substrates, anti-nutritional factors present in feeds; Microbial detoxification of aflatoxins; Single cell protein, Bioinsecticides; Biofertilizers; Recent advances in microbial biotechnology.

ABT 751: Advances in Crop Biotechnology

3+0

UNIT I: Conventional versus non-conventional methods for crop improvement; Present status and recent developments on available molecular marker, transformation and genomic tools for crop improvement.

UNIT II: Genetic engineering for resistance against abiotic (drought, salinity, flooding, temperature, etc) and biotic (insect pests, fungal, viral and bacterial diseases, weeds, etc) stresses; Genetic Engineering for increasing crop productivity by manipulation of photosynthesis, nitrogen fixation and nutrient uptake efficiency; Genetic engineering for quality improvement (protein, essential amino acids, vitamins, mineral nutrients, etc); edible vaccines, etc.

UNIT III: Molecular breeding: constructing molecular maps; integrating genetic, physical and molecular maps; diversity assessment and phylogenetic analysis; molecular tagging of genes/traits; selected examples on marker assisted selection of qualitative and quantitative traits.

UNIT IV: Discussion on application of molecular, transformation and genomic tools for the genetic enhancement in some major field crops such as rice, wheat, cotton, maize, soybean, oilseeds, sugarcane etc.

ABT 752: Advances in Functional Genomics and Proteomics

2+0

UNIT I: Genome sequencing and functional genomics; Human, animal, plant, bacterial and yeast genome projects; genome annotation; ab initio gene discovery; functional annotation and gene family clusters; etc.

UNIT II: Functional analysis of genes; RNA-mediated interference; gene knockoffs; Gene traps/ T-DNA insertion lines; homologous recombination; microarray profiling; SAGE; SNPs/variation; yeast-two hybrid screening; gene expression and transcript profiling; EST contigs; EcoTILLING; allele/gene mining; synteny and comparative genomics; Genome evolution, speciation and domestication etc.

UNIT II: Proteomics: protein annotation; protein separation and 2D PAGE; mass spectroscopy; protein microarrays; protein interactive maps; structural proteomics: protein structure determination, prediction and threading, software and data analysis/management etc.

UNIT IV: Discussion on selected papers on functional genomics, proteomics, integrative genomics etc.

ABT 801: Commercial Plant Tissue Culture

2+0

UNIT I: Micropropagation of commercially important plant species; plant multiplication, hardening, and transplantation; genetic fidelity; scaling up and cost reduction; bioreactors; synthetic seeds; management and marketing.

UNIT II: Production of useful compounds via biotransformation and secondary metabolite production: suspension cultures, immobilization, examples of chemicals being produced for use in pharmacy, medicine and industry.

UNIT III: Value addition by transformation; development, production and release of transgenic plants; patent, biosafety, regulatory, environmental and ethic issues; management and commercialization.

UNIT IV: Some case studies on success stories on commercial applications of plant tissue culture. Visits to some tissue culture based commercial units/industries.

ABT 802: Advances in Animal Biotechnology

2+0

UNIT I: Advances in animal cell culture technology, suspension culture technology, advances in commercial scale productions of mammalian cells.

UNIT II: Advances in cell cloning and cell hybridization, advances in monoclonal antibody production technology; Advances in diagnostic technology; Computational vaccinology, reverse genetics based vaccines.

UNIT III: Advances in embryo manipulation, knock out and knock in technology, advances in animal cloning technology, stem cell technology; Advances in development of animal models for human diseases using transgenic animal technology.

UNIT IV: Advances in genetic basis for animal disease resistance; Molecular methods for animal forensics; Advances in animal genomics, proteomics.