

**Department of Biotechnology, S.K. University, Anantapur**  
**Pre M.Phil/Ph.D Written Examination – 2008**

**Paper II – Research Specialization: Plant Biotechnology and Genetic Engineering**

**Time – 3 hours**

**Maximum Marks – 100**

**I. Abiotic Stress and drought responses of Plants**

Abiotic stresses affecting plant productivity; basic principles of crop improvement programme under stress, interactions between biotic and abiotic stresses. Drought characteristic features, water potential in the soil, plant and air continuum; development of water deficits, physiological processes affected by drought; drought resistance mechanisms; escape dehydration postponement (drought avoidance), dehydration tolerance, and characteristics of resurrection plants; osmotic adjustment osmo0protectants, stress proteins; water use efficiency as a drought resistance trait;

**II. Molecular aspects of drought stress tolerance**

Molecular responses to water deficit; stress perception, expression of regulatory and functional genes and significance of gene products; stress and hormones, ABA as a signaling molecule, cytokinin as a negative signal; Stress responsive transcription factors, DREB, EREBP and NAC family, oxidative stress; reactive oxygen species (ROS); role of scavenging systems (SOD, Catalase etc.).

**III. Physiological and Molecular aspects of Salinity, Temperature and Heavy metal stresses**

Salinity, species variation in salt tolerance; salinity effects at cellular and whole plant level, tolerance mechanisms; salt tolerance in glaucophytes and halophytes; breeding for salt resistance. High temperature stress; tolerance mechanisms; role of membrane lipids in high temperature tolerance; functions of HSP's. Chilling stress; effects on physiological processes; crucial role membrane lipids. Heavy metal stress; Aluminum, Lead and cadmium toxicity in acid soils; role of phytochelatin (heavy metal binding proteins).

**IV. Genetic Engineering of Plants**

Restriction endonucleases and other enzymes; electrophoretic techniques; Cloning – phage and plasmid vectors, cosmids, shuttle vectors, yeast vectors, artificial chromosomes, chromosome walking, Genomic and cDNA libraries; Subtractive, suppression and colony hybridization; Differential display. Southern blot, northern blot and western blot; Dot and slot blots; Methods of preparing probes; Transformation, selection and expression of cloned DNA; Sequencing of DNA. Synthesis of oligonucleotides; Site directed mutagenesis; Polymerase chain reaction;

**V. Transgenic Technology for crop Improvement**

Gene transfer in plants; Marker genes: reporter genes, selectable markers, chimeric gene vectors. Methods of gene transfer physical, chemical and vector mediated and virus mediated gene transfer. *In Plant* transformation, floral dip transformation. Transgenics against biotic, abiotic stresses; insect resistance, virus resistance, herbicide and drought resistance and quality parameters; improved storage, longer life, male sterility, terminator technology. Molecular marker technology for crop improvement; RFLP, RAPD, AFLP, SSRs.