

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Prerequisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Plant Stress Physiology: Concepts and Strategies  ALS-DSE 9	4	2	0	2	VI Sem	Nil

**Course Learning Objectives:**

This course explores the physiological, biochemical, and molecular mechanisms by which plants respond to environmental stresses. It covers abiotic and biotic stress factors, their impact on plant growth and development, and adaptive mechanisms to mitigate stress effects. The course also introduces strategies for improving stress tolerance in crops.

**Learning Outcomes:**

At the end of this course students will be able to:

- Identify different types of plant stresses and their effects on plant physiology.
- Understand the molecular and biochemical responses of plants to stress.
- Analyze plant adaptation and tolerance mechanisms under stress conditions.
- Explore strategies to enhance plant resilience against environmental challenges.
- Apply knowledge of plant stress biology in agricultural and environmental contexts.

**Theory : 30 Hours**

**Unit 1: Introduction to Plant Stress Physiology**

**02 Hours**

Types (abiotic and biotic), Perception, Acclimation vs Adaptation, Phenotypic plasticity.

**Unit 2: Abiotic and Biotic Stress**

**12 Hours**

Drought stress- Physiological and Biochemical responses, Resistance or Tolerance mechanisms

Salinity- Osmotic and Cytotoxic effects, Ion homeostasis, Salt-tolerant mechanisms: Developmental and Physiological protective mechanisms – exclusion vs tolerance, Osmoprotectants, Ion transporters, Compatible solutes- glycine betaine, proline  
Temperature - Cold and heat stress (in brief)

Stress caused by Pathogens, Herbivores, Parasitic plants and Weeds, Susceptibility and Resistance, PR proteins, Pattern-triggered immunity and Effector triggered immunity.

**Unit 3: Stress Sensing, Signaling and Tolerance Mechanisms****14 Hours**

Hormonal regulation (Abscisic acid, Jasmonic acid, Salicylic acid), Reactive Oxygen Species and Nitrous Oxide, Salt Overly Sensitive pathway, Late embryogenesis abundant proteins (LEA), Antioxidant enzymes (Superoxide dismutase, Catalase, Peroxidase), Osmolytes, Secondary metabolites (Alkaloids, phenolics and terpenoids), Chaperones (Heat Shock Proteins), Cryoprotectants, Phytoalexins

**Unit 4: Crop Improvement Strategies****02 Hours**

Traditional plant breeding (Mutation breeding, Protected cultivation) and Biotechnological approaches (brief account of stress tolerant genetically engineered plants).

**Practicals:****60 hours**

- To study the effect of salt stress on seed germination (percentage, plant shoot and root length).
- To study the effect of stress (anyone) on chlorophyll content.
- To determine electrolyte leakage in stressed plants.
- To determine SOD or peroxidase enzyme activity in control and stress plants.
- Study of plant adaptations under stress (Stomatal closure, Leaf curling, Root elongation, Stunted plant growth, Wilting) (through photographs).
- To demonstrate the effect of stress on total protein through 2-D gel electrophoresis profile (through photographs).
- Effect of stress on plant membranes (photographs).
- Effect of biotic stress on plants through photographs (necrosis, rotting, nematode attack, apple scab, SAR) (through photographs).

**Suggested Readings:**

- Taiz, L., Zeiger, E., Moller, I. M., Murphy, A. (2018). *Plant Physiology and Development*, 6th edition. New York, NY: Oxford University Press, Sinauer Associates.
- Bhatla, S.C., Lal, M.A. (2018). *Plant Physiology, Development and Metabolism*. Singapore: Springer Nature, Singapore Pvt. Ltd.
- Giri, B., & Sharma, M. P. (Eds.) (2021). *Plant Stress Biology: Strategies and Trends*. Springer Nature.
- Buchanan, B. B., Gruissem, W., & Jones, R. L. (Eds.) (2015). *Biochemistry and molecular biology of plants*. John Wiley & sons.

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.