DEPARTMENT OF PLANT PHYSIOLOGY

PROGRAMMES

1 M.Sc. Minor and Supporting Courses
2 Ph.D.

Courses Offered:

M.Sc.

S.No.	Course No.	Title of the Course	Cr. Hrs.
1	PPHY-511	Physiological aspects of Mineral Nutrition	3(2+1)
2	PPHY-512	Hormonal regulation of plant growth & development	3(2+1)
3	PPHY-521	Principles of Plant Physiology	3(2+1)
4	PPHY-522	Physiological & Molecular Response of Plants to Abiotic Stresses	3(2+1)

Ph.D.

S.No.	Course No.	Title of Course	Cr. Hrs.
1	PPHY-611	Post Harvest Physiology	3(2+1)
2	PPHY-622	Seed Physiology	3(2+1)

DESCRIPTION OF COURSES

PPHY-511: PHYSIOLOGICAL ASPECTS OF MINERAL NUTRITION 3(2+1)

Theory:

Overview of essential mineral elements.

Nutrient uptake by root cell and their transport and movement in developing grain.

Molecular mechanism of ion uptake, transport and their functional regulation.

Molecular physiology of micronutrients acquisition. Strategies plants adopt to acquire and transport minerals under deficit level.

Physiological and molecular mechanisms :underlying differential nutrients efficiency in crop genotypes.

Breeding crop-variety for improved nutrients efficiency. Plants response to mineral toxicity,

Practical:

Physiological and biological changes in plants under nutrients sufficiency and deficiency level.

Quantification of pigment level.

Enzyme activities.

Suggested Readings:

Barker, AB & Pilbeam DJ.2007. Hand book Plant Nutrition. CRC. Press

Epstein, E. 2007. Mineral Nutrition of Plants. John Wiley & sons.

PPHY-512: HORMONAL REGULATION OF PLANT GROWTH AND DEVELOPMENT 3(2+1)

Theory:

Definition and classification of plant growth regulators- Hormones, endogenous growth substances and synthetic chemicals, Endogenous growth regulating substances other than hormones, Tricontanol, Phenols, Polyamines, Jasmonates, Concepts of growth hormone.

Site of synthesis, biosynthesis pathway and metabolism and influence on plant growth development of individual group of hormone- Auxins, Gibberlins, cytokinins, ABA, ethylene and brassinosteroids,

Hormone mutants and transgenic plants in understanding role of hormones.

Singnal perception, transduction and effect of functional gene level of different hormone-Auxins-cell elongation, Gebberllins-germination of dorment seeds, Cytokinines-cell division, retardation of senescences of plant parts, Abscisic acid-stomatal closure and induction of drought resistance, Ethylene- fruit ripening.
Interaction of hormone in regulation of plant growth and development processes, Rooting of cuttings, Flowering, Apical dominance, molecular aspects of control of reproductive growth and development.
Synthetic growth regulators- classification, their effect on plant growth and development. practical utility in agriculture and horticulture.

Practical:
Auxins effect on rooting of cuttings, abscission, apical dominance.
Gibberlline effect on germination of dormant seed.
Cytokinine effect on apical dominance and senescence.
ABA effect on stomatal movement.
Ethylene effect on breaking dormancy.

Suggested Readings:
Hopkins, WG & Huner NPA.2004. Introduction to plant physiology. John Wiley & sons.
Hota,Dharamvir. 2007.Synthetic plant growth regulators.
Basra. A.S.,2004.Plant Growth regulators in Agriculture and Horticulture, International Book Distributing Co.

PPHY-521: PRINCIPLES OF PLANT PHYSIOLOGY 3(2+1)

Theory:
Cell organelles and their physiological functions, structure and physiological functions of cell wall, cell inclusions; cell membrane: structure and functions.
Soil and plant water uptake, water and its role in plants, properties and functions of water in the cell water relations, cell water terminology, water potential of plant cells.
Mechanism of water uptake by root, transport in root, aquaporins, movements of water in plants, Micorrhizal association on water uptake.

Water loss from plants: Evapo-transpiration. Transpiration, driving force for transpiration, plant factors influencing transpiration rate.
Stomata: structure and function, mechanism of stomatal movement, antitranspirants.
The role of mineral nutrition in plant metabolism: essential elements, classification based on functions of elements in plants.
Physiological and metabolic functions of mineral elements, critical levels, deficiency symptoms, nutrient deficiency and toxicity, foliar nutrition.
Photosynthesis and its importance in bio-productivity. Photochemical process, photochemical reactions, CO_2 reduction in calvin cycle, supplementary pathway of CO_2 fixation in C_4 and CAM plants and its significance.
Mitochondrial respiration
Growth and differentiation, Hormonal concept of growth and differentiation, plant growth hormones and their physiological role, synthetic growth regulators, growth retardants, apical dominance, senescence, fruit growth, abscission.

Practical:
Measurement of plant water status: RWC, WSD, VPD.
Measurement of transpiration rate: Porometry study, influence of ABA on stomatal closing.
Deficiency systems of nutrients.
Estimation of chlorophyll and chlorophyll stability index.
Oxygen evolution during photosynthesis.

Suggested Readings:
Hopkins, W.G. & Huner N.P.A.2004 Introduction to plant physiology. John Wiley& Sons.
Salisbury F.B. & Ross, C.1992. Plant Physiology, IVth Edition, Wardsworth Publication.
Mukherji, S. & Ghosh, A. K. 2005.Plant Physiology. New Central Book Agency, Kolkata.

PHY-522: PHYSIOLOGICAL AND MOLECULAR RESPONSES OF PLANTS TO ABIOTIC STRESSES3 (2+1)

Theory:

Response of plants to abiotic stress: Abiotic stresses affecting plants productivity. Basic principles of crop improvement programme under stress, Interaction between biotic and abiotic stress.

Drought- characteristic features, water potential in the soil- Plant air continuum, Development of water deficits, energy balance concept.

Physiological process affected by drought, drought resistance mechanism,

Molecular response to water deficit: stress perception, Expression of regulatory and genes and significance of gene products.

Stress and hormones- ABA as a signaling molecule, Cytokinin as a negative singnal. Oxidative stress- ROS, Role of scavenging system (SOD, Catalase etc.).

High temperature stress tolerance mechanism.

Chilling stress: Effect on physiological processes.

Salinity: Salt tolerance mechanism.

Practical:

Measurement of drought tolerance on the basis of chlorophyll stability index,

Measurement of drought tolerance on the basis of cell membrane stability,

Measurement of salt tolerance on the basis of cell membrane stability

Effect of drought on transpiration

Effect of salinity on transpiration

Suggested Readings

J. Levitt 1981. Plant responses to environmental stresses (vol. I &II). Academic Press, New York & London

Dwivedi & Dwivedi (2005) Physiology of abotic stress in plants. Agro bios. India

Paul.J.Kramer, (1983). Water relations of Plants. Academic Press.

Panda S.K.(2002) Advances in Stress Physiology of Plants. Scientific Publishers, Jodhpur

PPHY-611: POST HARVEST PHYSIOLOGY 3(2+1)

Theory:

Senescence: Factors influencing senescence, ripening and post harvest life of flower, vegetables and seeds.

Molecular mechanism of senescence and ageing, senescence associated genes.
Functional and ultra-structural changes in chloroplast membrane, mitochondria and cell wall during senescence and ripening.
Role of ethylene in senescence and ripening.
Biotechnological approaches to manipulate ethylene biosynthesis and action.

Practical:
Physiological and biological changes during senescence and ripening.
Determination of scavenging enzymes like SOD, PPO, Peroxidase, Catalase, Acid-p etc.
Estimation of ripening related enzyme activity.
Estimation of chlorophyll content.
Measurement of dark and alternate respiration rate during senescence and ripening.

Suggested Reading:
Jeffrey K Brecht & Weichmann J. 2003. Post harvest physiology and pathology of vegetables. CRC Press.

PHY-622: SEED PHYSIOLOGY 3(2+1)

Theory:
Seed and fruit development, abortion, proximate mechanism of abortion. Hereditary and environmental effects on seed development.
Importance of seed, seed structure and function, physiological and biochemical changes during seed and fruit development and abortion.
Seed storage: resources and sources of assimilation for seed development.
Pathway of movement of assimilates in developing grains of monocots, chemical composition of seed, storage of carbohydrates, proteins and fats in seed and their biosynthesis.
Seed respiration, mitochondrial activity, seed ageing, mobilization of stored food, oxidation 0f starch, protein and fats, and utilization of breakdown products by embryonic axis.
Seed viability, seed vigour, seed dormancy, types and regulation
Means to overcome seed dormancy.

Practical:

Determination of seed protein

Alpha-amylase activity in germinating seeds.

Role of GA in inducing alpha-amylase activity, protease, and lipase activity in germinating seed.

Seed viability test and accelerated ageing test.

Suggested Readings:

Srivastav, LM. Plant Growth and Development: Hormones and Environment. Academic Press.

Bewley, J.D. & Black, M. 1985. Seed Physiology of Development and Germination. Plenum Publication.

Copeland, L.O. & McDonald M.B. Principles of Seed Sciences and Technology. Burgers Publ.Co.