

BOT. 502	ARCHEGONIATE	2+1	
	Sem. 1		
<p>Introduction to plant diversity in bryophytes, pteridophytes and gymnosperms and their origin, classification, comparative morphology and reproduction of important groups and their economic importance. Phylogeny, evolutionary trends, fossilization and interlinkages between these plant groups and with others.</p> <p>Practical: Study of structure and morphology of vegetative and reproductive organs of the representative species of above classes.</p>			
BOT. 503	MORPHOLOGY, MORPHOGENESIS	2+1	Sem. 1
	AND TAXONOMY OF ANGIOSPERMS		
<p>Morphology and morphogenesis of plant organs, their origin, development and evolutionary trends; principles of taxonomy as applied to systematics, taxonomic structure, classification, characters and plant nomenclature. Systematic position of families on the basis of phylogeny and economic importance; chemotaxonomy and cytotaxonomy, palynology in relation to taxonomy and numerical taxonomy.</p> <p>Practical: Study of characters of representative genera in the laboratory and field; herbarium collection.</p>			
BOT. 504	PLANT EMBRYOLOGY	2+1	Sem. 1
<p>Development and structure of micro- and megasporangium, male and female gametophytes; pollen physiology, preservation, male sterility, pollination, fertilization, self-incompatibility, development of endosperm, embryo, seed coat; polyembryony, apomixis, parthenocarpy and parthenogenesis; <i>in vitro</i> culture of embryo and pollen, production of androgenic plants and somatic hybridization. Embryology and relation to taxonomy.</p> <p>Practical: Study of micro- and megasporogenesis, embryo, endosperm and seed coat through dissection and microtomy; embryo and anther culture.</p>			
BOT. 505	PLANT ANATOMY	2+1	Sem.
	II		
<p>Structure and development of cell wall, apical meristems and cellular differentiation, formation of complex tissue, vascular cambium and its organisation, secondary tissues and their evolution, anomalous secondary growth, periderm and abscission, vascular transition between root and shoot, anatomy in relation to taxonomy.</p> <p>Practical: Study of anatomy of root, stem, leaf and flower through microtomy; maceration and clearing technique. Study of normal and abnormal growth.</p>			
BOT. 506.	PLANT ECOLOGY	2+1	Sem.
	II		
<p>Definitions; different levels of biological organisation; ecosystem concept, components of ecosystem, trophic structure, functions of ecosystem-energy flow, productivity and biogeochemical cycles; classification of ecosystems; habitat and niche; plant environment; ecological adaptations, population ecology, ecotypes and ecads, plant communities, ecological succession; environmental pollution; conservation and management of natural resources.</p> <p>Practical: Measurement of climatic and edaphic factors; quantitative and qualitative analysis of vegetation.</p>			
BOT. 507	ECONOMIC BOTANY	2+1	Sem. I or II
<p>Historical development in economic botany. Geographical distribution of economic plants-centres of diversity. Vivilovian law and parallel variation. Methods of plant introduction, acclimatization and utilization. Quarantine principles. Origin, distribution, classification, production and utilization of economic plants of various groups as cereals, pulses, fibres, sugar</p>			

crops. History of cultivation and sources of forest products, tannins, white babul and dye material, wattle, indigo, rubber, gums and resins, *Acacia*, guar, Pinus, paper pulp, medicines and alkaloids, nuts, and beverages, fumigatories and mastigatories, tobacco, betel-vine, arecanut, insecticides, neem, lemongrass, nontraditional economic plants; jojoba, guayule, utilization of crops residues; cotton stalks, paddy husk, coconut fibres.

Practical: Study of plant specimens of economic importance and their acquaintance with their products. Exploration, collection and preservation of economically important plants and their products.

BOT. 601. REPRODUCTIVE BIOLOGY OF 2+1 Sem. II

ANGIOSPERMS

Development and ultrastructure of anther, pollen, ovule, embryo sac. Biochemical constituents of pollen and their significance. Concept, composition and significance of male and female germ unit & pollination, biology, pollen-pistil interaction and fertilization; self-incompatibility methods and mechanism of overcoming interspecific crossing barriers. Developmental details and morphogenesis of endosperm, embryo, fruit and seed. Isolation and manipulation of sperm cells and embryo sac, physiology and biochemistry of generative cells and male gametes. Plant transformation through sexual structures.

Practical: Developmental studies of pollen, embryo sac, embryo, fruit and seed of selected crop plants through dissection, microtomy, clearing technique and histochemical tests.

BOT. 602 APPLIED EMBRYOLOGY AND 3+1 Sem. I
TISSUE CULTURE

Pollen collection, preservation, viability and their nutritional requirements; male sterility, pollen allergens, concept of pollen selection and its significance in crop improvement programme; artificial pollination and its role in crop improvement. Plant reproduction under environmental stresses. Recent advances in *in vitro* culture of anther, embryo and endosperm, pollen embryos, morphogenesis of embryo and endosperm, pollen embryos, morphogenesis of embryoids and plants, concept of somatic embryogenesis; protoplast culture, induction of somaclonal variation and its practical utility. *In vitro* methods as applicable to agricultural crops, forestry trees and medicinal plants. Topics of current interest.

Practical: Studies of different methods of pollen collection and preservation, culturing of anthers, pollen and young embryos using various culturing media and study of differentiation and development.

BOT. 603 CONTEMPORARY PLANT ANATOMY 2+1 Sem. I or II

Ultrastructure in relation to growth and differentiation in plants, detailed study of development and factors controlling the development of cells, tissue and organs, experimental studies and differentiation of meristems, control of differentiation and experimental investigation of xylem, phloem, secretory structure, economic importance of plant secretions, wound healing and behaviour of tissues in compatible and incompatible graft unions, environmental and nutritional factors in relation to structure and development of plants, organs and tissue; developmental anatomy of fruits and seeds.

Practical: Study of structure of cell wall and anatomy of various plant organs through histochemical methods and through clearing, maceration and microtome preparation.

BOT. 604 ADVANCED PLANT ECOLOGY 2+1 Sem. I or II

Principles of ecosystem, energy dynamics, stability, limiting factors and plant community, environmental factors in relation to plant growth, competition, factors in arid and semiarid regions of India, system analysis, world biota, floristic regions of India and biodiversity. Plant and soil conservation, environmental pollution and plant growth.

Practical: Detailed study of vegetation in different environmental conditions, study of stabilization of sand dunes in relation to survival, productivity, competition and succession.

BOT. 605. CURRENT TOPICS IN BOTANY 2+0 Sem. I or II

Synthetic seeds, cryopreservation and its theory. Gene expression regulating meristem functions, pollen expressed genes and their regulation, Pollen pigments, Signal transduction during fertilisation. Atmospheric ozone and its impact on plants. Global warming.

BOT. 591 SEMINAR 1+0
Sem. I & II

BOT. 600 MASTER'S RESEARCH

BOT. 700 Ph.D. RESEARCH

Plant Physiology

UNDERGRADUATE COURSES

P.Phy. 401 GENERAL PLANT PHYSIOLOGY 4+0 Sem. I & II

Concept of water potential, water absorption, transport, transpiration and stomatal physiology; physiological basis of injury and resistance to drought, waterlogging, salinity, and temperature; plant membranes, structure and function; passive and active ion uptake; phloem transport; physiological roles and deficiency disorders of mineral elements. Photosynthesis, pigments involved, photophosphorylation, CO₂ reduction, C₃, C₄ and CAM pathways, photorespiration. Respiration, glycolysis, aerobic and anaerobic, pentose phosphate shunt; plant growth and development, dynamics, periodicity and correlation. Plant hormones, chemistry, biosynthesis, transport, metabolism, physiological roles and mechanism of action; Mechanism of seed and bud dormancy, seed viability and germination; root, stem and leaf development, photoperiodism, vernalization, physiology of flowering and sex expression, phytochrome; Fruit development and ripening; senescence and abscission; plant physiology in agriculture.

POSTGRADUATE COURSES

P. Phy. 501 PLANT WATER RELATIONS AND 3+1 Sem. I
STRESS PHYSIOLOGY

Water relations of cells, tissues and organs: energy and work, free energy, chemical potential, concept and components of water potential. Soil-water relationship; quantification of soil-water relations and soil plant atmosphere continuum. Mechanism of water uptake and transport; driving forces, resistance to water movement in the plant system; loss of water. Environmental influence on plant water relationship. Transpiration and evapotranspiration. Factors governing transpiration and antitranspirants. Stomatal physiology: Structure and function of stomata, mechanism of stomatal opening and closing. Water use efficiency and its significance. Stress and strain concept. Environmental factors influencing plant growth and productivity under stresses. Microclimate and its effect. Water stress: drought, its definition and quantification. Water deficit and plant growth. Physiological and biochemical functions / responses injury affected by water stress. Adaptive strategies for drought resistance. Importance of osmoregulation and stress responsive proteins. Screening for drought resistance – empirical and analytical techniques, approaches to breeding drought resistance. Waterlogging / Oxygen deficiency and its effects on plant growth. Salt stress: Saline and alkaline soils, salt stress injury, mechanism of salt tolerance and halophytes. Temperature stress: High temperature stress, heat shock proteins, chilling and frost injury, and mechanism of tolerance. Light stress: high and low light stresses, UV-B effect on plant growth and development. Pollutant and heavy metal stress: chemical, air and gaseous pollutants and their effect on plant growth, green house gases and global warming. Effect of heavy metals on plant growth and development.

Practical: Determination of water status of plant tissues and organs by measuring water potential and its components and relative water content. Experiments on stomatal physiology and transpiration. Demonstration of plants responses to stresses through recent techniques.

P. Phy. 505 CELL PHYSIOLOGY AND ORGANIC 3+0 Sem. I

ORGANIC METABOLISM

Cell theory, structure of eukaryotic plant cell, structural and functional details of cell wall, cell membrane, cytoplasm, nucleus, chloroplast, mitochondria, ribosomes, endoplasmic reticulum, Golgi apparatus, microbodies, peroxisomes, glyoxysomes, spherosomes and lysosome, vacuole, cytoskeleton, microtubules and microfilaments, cytoplasmic streaming, nuclear, chloroplast and mitochondrial genome, their expression and interaction. Nucleic acid and protein biosynthesis, fats and oils, plants lipids and their importance, secondary plant products (such as cutin, suberin, waxes, terpenes, phenolic compounds, lignin, flavonoids, etc.) and their importance.

P. Phy. 506 PLANT REGULATORS 3+1 Sem. II

Terminology, definitions, classification, auxins, gibberellins, cytokinins, abscisic acid and ethylene –discovery, occurrence, site of synthesis, structure and activity relationship, transport, biosynthetic pathways and metabolism and their influence on plant growth. Concept, mode and mechanism of hormone action – hormone receptors and binding sites. Synthetic regulators, endogenous growth regulators – brassinosteroids, triacontanol and growth retardants, detection and assay. Physiological roles of plant growth regulators on rooting of cuttings, apical dominance, dormancy, germination, flower and fruit retention, sex modification, ripening, senescence, and abscission. Commercial applications of growth promoters and retardants in agricultural and horticultural crops. Herbicide physiology. Classification of herbicides based on mode of action. Herbicide resistance.

Practical: Extraction, separation, bioassay and chemical identification and estimation of plant hormones; effect of plant regulators on growth and developmental processes. Tissue culture techniques and their applications.

P. Phy. 507 SENESCENCE AND ABCISSION 2+1 Sem. I

Nature, extent and significance of cotyledonary, foliar, fruit, plant senescence and abscission. Physiology, biochemistry and mechanism of these processes under natural, induced conditions; chemical regulation of senescence and abscission, factors affecting the processes.

Practical: Study of physiological and biochemical changes during natural and induced senescence and abscission, hormonal regulation of these processes.

P. Phy. 508/ LABORATORY METHODS IN 0+2 Sem. II

Bot. 508 PLANT PHYSIOLOGY

Microtechnique for histological and histochemical studies; manometric techniques, electrophoresis; chromatography; spectrophotometric techniques and infrared gas analysis. Measurement of water potential and its components, stomatal conductance.

P. Phy. 509/ SEED PHYSIOLOGY 2+1 Sem. I

ST. 503

Characteristic features of seed development and maturation. Germination and its control. Dormancy, viability, vigour, storage and longevity of seed. Factors affecting seed storage and role of moisture, temperature, RH and moisture equilibrium. Seed deterioration causes, theories and methods of control. Short and medium term storage, controlled storage, germplasm storage and cryopreservation.

Practical: Methods of testing germination, viability and vigour and breaking of dormancy of seeds. Presoaking treatment for improving germination. Physiological and biochemical changes during seed germination.

P. Phy. 510 CROP PRODUCTIVITY AND 2+1 Sem. II

MODELLING

Crop growth analysis, key growth parameters, canopy architecture, light interception and concept of source-sink relationships. Allometric growth relationships, partitioning efficiency and harvest index. Plant growth analysis techniques, yield analysis, theoretical and actual yields. Physiology of major field crops. Plant ideotypes. Crop growth models – empirical models testing and yield prediction.

Practical: Computer applications in plant physiology, crop productivity and modelling.

P. Phy. 601 ADVANCED NUTRITION AND 3+0 Sem. I

METABOLISM

Ionic relation of cells, tissues, organs and whole plant; transport systems: ion transport and metabolism, regulation of transport, symplastic movement and apoplastic movement. Salt relation of specialized plants like halophytes, patterns of redistribution of ions, salt relations and growth, cell models of transport physiology, correlations between the fine structure of cytoplasm and transport functions. Regulation and control of transport processes by cell metabolism, medium distance and long distance transport, nitrogen productivity concept.

P. Phy. 602 ADVANCED STRESS PHYSIOLOGY 3+0 Sem. I

Advance account of molecular and metabolic responses to various stresses, water, salt, temperature, air pollution, heavy metals and radiation, mechanisms of their injury and resistance; osmoregulation, mechanisms of stomatal movement. Residual effect of pesticides. Interactive responses to multiple stresses.

P. Phy. 603 PHYSIOLOGY OF FLOWERING 3+0 Sem. II

Flowering, light and temperature control; induction, threshold, persistence, perpetuation and reversion. Florigen – anthesin concept and characterization. Floral inhibitors and fractional induction. Importance of light and dark period in relation to temperature and fractional induction, role of phytochrome and circadian rhythms; hormonal control. Biochemical and molecular aspects of floral induction and expression, sex expression, physiology and control.

P. Phy. 604 MECHANISM OF PLANT HORMONE 3+0 Sem. II
ACTION

Hormone perception and signal transduction; nature of hormone receptors, hormonal regulation of gene expression; calcium and hormone action. Oligosaccharins, brassinolides, polyamines and other molecules having hormone-like activities; jasmonates – nontraditional regulators of plant growth, development and gene expression. Role of plant hormone sink plant defense mechanisms.

P. Phy. 605/ ADVANCE SEED METABOLISM 3+0 Sem. II
ST. 602

Advanced account of the physiology of seed viability and deterioration, molecular, metabolic and hormonal aspect of seed viability, seed germination and seedling vigour.

P. Phy. 591 SEMINAR 1+0
Sem. I & II

P. Phy. 600 MASTER'S RESEARCH

P. Phy.700 Ph.D. RESEARCH