

SYLLABUS FOR ENTRANCE EXAMINATION TO PhD PROGRAMME IN
FRUIT SCIENCE

Unit 1: Tropical and Dry Land Fruit Production

Commercial varieties of regional, national and international importance, eco-physiological requirements, recent trends in propagation, scion-stock relationship, planting systems, cropping systems, canopy management, nutrient management, water management, fertigation, role of bio-regulators, abiotic factors limiting fruit production, physiology of flowering, pollination, fruit set and development, honeybees in cross pollination, physiological disorders—causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones (AEZ) and industrial supports. Crops: Mango, Banana, Citrus, Papaya, Guava, Sapota, Annonas, Aonla, Bael, Wood apple, Jamun, Pomegranate, Ber and minor fruits of tropics.

Unit 2: Subtropical and Temperate Fruit Production

Commercial varieties of regional, national and international importance, eco-physiological requirements, recent trends in propagation, scion-stock relationship, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bio - regulators, abiotic factors limiting fruit production, physiology of flowering, pollination, fruit set and development, honeybees in cross pollination, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones (AEZ) and industrial supports. Crops: Avocado, Pineapple, Jackfruit, Mangosteen, Carambola, Fig and Rambutan, Litchi, Loquat, Apple, Pear, Quince, Grapes, Plums, Peach, Apricot, Cherries, Persimmon, Kiwifruit, Strawberry, Walnut, Almond, Pistachio, Hazelnut.

Unit 3: Canopy Management in Fruit Crops

Canopy management - importance and advantages; factors affecting canopy development; Canopy types and structures with special emphasis on geometry of planting, canopy manipulation for optimum utilization of light. Light interception and distribution in different types of tree canopies; Spacing and utilization of land area - canopy classification; Canopy management through rootstock and scion; Canopy management through plant growth retardants, training and pruning and management practices; Canopy development and management in relation to growth, flowering, fruiting and fruit quality in temperate fruits, Grapes, Sapota, Guava, Citrus and Ber.

Unit 4: Breeding of Fruit Crops

Origin and distribution, taxonomical status - species and cultivars, cytogenetics, genetic resources, blossom biology, breeding systems, breeding objectives, breeding constraints idea types, approaches for crop improvement – introduction, selection, hybridization, mutation breeding, polyploidy breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, biotechnological interventions, achievements and

future thrust in the following selected fruit crops. Crops: Mango, Banana, Pineapple, Citrus, Grapes, Guava, Sapota, Jackfruit, Papaya, Custard apple, Aonla, Ber, Litchi, Jamun, Apple, Pear, Plums, Peach, Apricot, Cherries and Strawberry.

Unit 5: Growth and Development

Definition, parameters of growth and development, growth dynamics, morphogenesis; Annual, semiperennial and perennial horticultural crops, environmental impact on growth and development, effect of light, photosynthesis and photoperiodism, vernalisation, effect of temperature, heat units, thermoperiodism; Assimilate partitioning during growth and development, influence of water and mineral nutrition during growth and development, biosynthesis of auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids, growth inhibitors, morphactins, role of plant growth promoters and inhibitors, developmental physiology and biochemistry during dormancy, bud break, juvenility, vegetative to reproductive interphase, flowering, pollination, fertilization and fruit set, fruit drop, fruit growth, ripening and seed development; Growth and developmental process during stress - manipulation of growth and development, impact of pruning and training, chemical manipulations in horticultural crops, molecular and genetic approaches in plant growth development.

Unit 6: Biotechnology of Fruit Crops

Harnessing bio-technology for improvement of horticultural crops, influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture; Callus culture -types, cell division, differentiation, morphogenesis, organogenesis, embryogenesis; Use of bioreactors and *in vitro* methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues, *ex vitro*, establishment of tissue culture plants; Physiology of hardening - hardening and field transfer, organ culture-meristem, embryo, anther, ovule culture, embryo rescue, soma clonal variation, protoplast culture and fusion; Construction and identification of somatic hybrids and cybrids, wide hybridization, *in vitro* pollination and fertilization, haploids, *in vitro* mutation, artificial seeds, cryopreservation, rapid clonal propagation, genetic engineering and transformation in horticulture crops, use of molecular markers. *In vitro* selection for biotic and abiotic stress, achievements of biotechnology in horticultural crops and application of gene editing tools in horticultural crops.

Unit 7: Principles and Practices of Plant Propagation

Introduction, life cycle in plants, cellular basis for propagation. Sexual propagation – apomixis, polyembryony, chimeras. Factors influencing seed germination, hormonal regulation of germination and seedling growth. Seed quality, treatment, packing, storage, certification and testing. Rooting of cuttings under mist and hot beds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Selection of elite mother plants. Establishment of budwood bank. Stock, scion and inter stock relationship and incompatibility. Physiology of dwarfing rootstocks. Rejuvenation of senile and seedling orchards progeny orchard and scion bank. Micropropagation *In vitro* clonal propagation,

embryogenesis, micro grafting and meristem culture. Hardening, packing and transport of micro-propagules.