Semester wise courses

Minimum Credit Requirements as per ICAR Recommendation and Credit offered

M.Sc. (Ag.) Horticulture (FRUIT SCIENCE)

Sr. No.	New Course Code	Course Title	Credit
First Semester			
Major Course			
1.	HOMP -711	Production of Plantation Crops	3(2+1)
2.	HOFS –711	Propagation and Nursery Management for Fruit Crops	3(2+1)
3.	HOFS – 712	Climate Management in Horticultural Production	1(0+1)
Minor Course			
4.	SS-732	Principles and Practices of Soil Fertility and Nutrient Management	3 (2+1)
Supporting Course			
5.	CSIT –705	Computer Orientation	3(1+2)
6.	MAS-815	Experimental Design	3(1+2)
Non Credit Compulsory Courses			
7.	MLI-501	Library and Information Services	1(0+1)
8.	LNG-502	Technical Writing and Communication Skills	1(0+1)
9.	ENV-506	Disaster Management	1(0+1)
Second Semester			
Major Course			
10.	HOFS-721	Tropical and Dry Land Fruit Production	3(2+1)
11.	HOFS –722	Subtropical and Temperate Fruit Production	3(2+1)
12.	HOFS– 723	Canopy Management in Fruit Crops	2(1+1)
13.	HOFS-899	Master's Research (Synopsis Presentation)	5(0+5)
Minor Course			
14.	ENT-734	Pests of Horticultural and Plantation Crops	2(1+1)
15.	AGFO-716	Agrometeorology and Crop Weather Forecasting	3 (2+1)
Non Credit Compulsory Courses			
16.	AEAB – 503	Intellectual Property and Its Management in Agriculture	1(0+1)
17.	HORT – 504	Basic Concepts in Laboratory Techniques	1(0+1)
18.	AEAB – 505	Agricultural Research, Research Ethics and Rural Development Programmes	1(0+1)
Third Semester			
Major Course			
19.	HOFS – 811	Biodiversity and Conservation of Fruit Crops	3(2+1)
20.	HOFS – 812	Breeding of Fruit Crops	3(2+1)
21.	HOFS – 813	Post Harvest Technology of Fruit Crops	3(2+1)
22.	HOFS – 780	Master's Seminar	1(0+1)
23.	HOFS-899	Research work	5(0+5)
Minor Course			
24.	ENT – 714	Techniques in Plant Protection	1(0+1)
25.	GPB – 713	Principles of Plant Breeding	3(2+1)
26.	SS – 723	Soil Fertility and Plant Nutrition	3(1+2)
Fourth Semester			
27.	HOFS – 899	Master's Research	20
Total Credit			76

Minimum Credit Requirements as per 32AcedemicConcial meeting Recommendation and Credit offered

Subject	Minimum Credit Requirements	Credit offered
Major	25	25
Minor	15	15
Supporting	05	06
Research	30	30
Total Credits	**75**	**76**
Compulsory Non-Credit Course	06	06

Major Courses Fruit Science 1st semester

HOMP -711 PRODUCTION OF PLANTATION CROPS 3(2+1)

Objective

To impart basic knowledge about the importance and production technology of plantation crops grown in India.

Theory

Role of plantation crops in national economy, export potential, IPR issues, clean development mechanism, classification and varietal wealth. Plant multiplication including *in vitro* multiplication, systems of cultivation, multitier cropping, photosynthetic efficiencies of crops at different tiers, rainfall, humidity, temperature, light and soil pH on crop growth and productivity, high density planting, nutritional requirements, physiological disorders, role of growth regulators and macro and micro nutrients, water requirements, fertigation, moisture conservation, shade regulation, weed management, training and pruning, crop regulation, maturity indices, harvesting. Cost benefit analysis, organic farming, management of drought, precision farming.

Crops

UNIT I: Coffee and tea
UNIT II: Cashew and cocoa
UNIT III: Rubber, palmyrah and oil palm
UNIT IV: Coconut and arecanut
UNIT V: Wattle and betel vine

Practical

Description of botanical and varietal features, selection of mother palms and seedlings in coconut and arecanut, soil test crop response studies and manuring practices, pruning and training, maturity standards, harvesting, Project preparation for establishing plantations, Visit to plantations.

HOFS –711 PROPAGATION AND NURSERY MANAGEMENT FOR FRUIT CROPS **3(2+1)**

Objective

Familiarization with principles and practices of propagation and nursery management for fruit crops.

Theory

UNIT I

Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixis, polyembryony, chimeras. Principles factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth.

UNIT II

Seed quality, treatment, packing, storage, certification, testing. Asexual propagation – rooting of soft and hard wood cutting under mist by growth regulators. Rooting of cuttings in hotbeds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principle and methods.

UNIT III

Budding and grafting – selection of elite mother plants, methods. Establishment of bud wood bank, stock, scion and inter stock, relationship – Incompatibility. Rejuvenation through top working – Progeny orchard
and scion bank.

UNIT IV

Micro-propagation – principles and concepts, commercial exploitation in horticultural crops. Techniques - *in vitro* clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture. Hardening, packing and transport of micro-propagules.

UNIT V

Nursery – types, structures, components, planning and layout. Nursery management practices for healthy propagule production.

Practical

Anatomical studies in rooting of cutting and graft union, construction of propagation structures, study of media and PGR. Hardening – case studies, micropropagation, explant preparation, media preparation, culturing – *in vitro* clonal propagation, meristem culture, shoot tip culture, axillary bud culture, direct organogenesis, direct and indirect embryogenesis, micro grafting, hardening. Visit to TC labs and nurseries.

HOFS – 712 CLIMATE MANAGEMENT IN HORTICULTURAL PRODUCTION 1(0+1)

Objective

To develop understanding about the impact and management of climate in horticultural production.

Theory

UNIT I

Introduction to climate change. Factors directly connected to climate change, average temperature, change in rainfall amount and patterns, rising atmospheric concentrations of CO_2, pollution levels such as tropospheric ozone, change in climatic variability and extreme events like receding of glaciers in Himalayas.

UNIT II

Sensors for climate registration and crop monitoring, phytomonitoring and biosensors, plants response to the climate changes, premature bloom, marginally overwintering or inadequate winter chilling hours, insect pests, longer growing seasons and shifts in plant hardiness for perennial fruit crops, flowering plants and other plant species.

UNIT III

Impact of climate changes on invasive insect, disease, weed, pests, horticulture yield, quality and sustainability, climate management in field production – mulching - use of plastic- windbreak- spectral changes- frost protection. Climate management in greenhouse- heating - vents - CO_2 injection - screens - artificial light.

UNIT IV

Climate management for control of pests, diseases, quality, elongation of growth and other plant processes- closed production systems around the world. Special protected cultivation now and in the future, growth chambers, production in space, biosphere, future aspects of closed

production, future greenhouse, use of LED as artificial light, future sensor types etc. clean development mechanism, role of tropical trees.

Major Courses Fruit Science 2nd semester

HOFS-721 TROPICAL AND DRY LAND FRUIT PRODUCTION 3(2+1)

Objective

To impart basic knowledge about the importance and management of tropical and dry land fruits grown in India.

Theory

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bioregulators, 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

UNIT I: Mango and Banana
UNIT II: Citrus and Papaya
UNIT III: Guava, Sapota and Jackfruit
UNIT IV: Pineapple, Annonas and Avocado
UNIT V**:** Aonla, Pomegranate, Phalsa and Ber, minor fruits of tropics

Practical

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical and arid zone orchards, Project preparation for establishing commercial orchards.

HOFS –722 SUBTROPICAL AND TEMPERATE FRUIT PRODUCTION 3(2+1)

Objective

To impart basic knowledge about the importance and management of subtropical and temperate fruits grown in India.

Theory

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bioregulation, abiotic factors limiting fruit production, physiology of flowering, fruit set and development, abiotic factors limiting production, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, precooling, storage, transportation and ripening techniques; industrial and export potential, Agri Export Zones(AEZ) and industrial support.

Crops

UNIT I: Apple, pear, quince, grapes

UNIT II: Plums, peach, apricot, cherries, hazlenut

UNIT III: Litchi, loquat, persimmon, kiwifruit, strawberry

UNIT IV: Nuts- walnut, almond, pistachio, pecan

UNIT V: Minor fruits- mangosteen, carambola, bael, wood apple, fig, jamun, rambutan, pomegranate

Practical

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical, subtropical, humid tropical and temperate orchards, Project preparation for establishing commercial orchards.

HOFS– 723 CANOPY MANAGEMENT IN FRUIT CROPS 2(1+1)

Objective

To impart knowledge about the principles and practices in canopy management of fruit crops.

Theory

UNIT I

Canopy management - importance and advantages; factors affecting canopy development.

UNIT II

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.

UNIT III

Spacing and utilization of land area - Canopy classification; Canopy management through rootstock and scion.

UNIT IV

Canopy management through plant growth inhibitors, training and pruning and management practices.14

UNIT V

Canopy development and management in relation to growth, flowering, fruiting and fruit quality in temperate fruits, grapes, passion fruits, mango, sapota, guava, citrus and ber.

Practical

Study of different types of canopies, training of plants for different canopy types, canopy development through pruning, use of plant growth inhibitors, geometry of planting; study on effect of different canopy types on production and quality of fruits.

Major Courses Fruit Science 3rd semester

HOFS – 811 BIODIVERSITY AND CONSERVATION OF FRUIT CROPS 3(2+1)

Objective

Understanding the principles of biodiversity and strategies in germplasm conservation of fruit crops.

Theory

UNIT I

Biodiversity and conservation; issues and goals, centers of origin of cultivated fruits; primary and secondary centers of genetic diversity.

UNIT II

Present status of gene centers; exploration and collection of germplasm; conservation of genetic resources – conservation *in situ* and *ex situ.*

UNIT III

Germplasm conservation- problem of recalcitrancy - cold storage of scions, tissue culture, cryopreservation, pollen and seed storage; inventory ofgermplasm, introduction of germplasm, plant quarantine.

UNIT IV

Intellectual property rights, regulatory horticulture. Detection of genetic constitution of germplasm and maintenance of core group.

UNIT V

GIS and documentation of local biodiversity, Geographical indication.

Crops

Mango, sapota, citrus, guava, banana, papaya, grapes, jackfruit, custard, apple, ber, aonla, malus*, Prunus* sp, litchi, nuts, coffee, tea, rubber, cashew, coconut, cocoa, palmyrah, arecanut, oil palm and betelvine.

Practical

Documentation of germplasm – maintenance of passport data and other records of accessions; field exploration trips, exercise on *ex situ* conservation – cold storage, pollen/seed storage, cryopreservation, visits to National Gene Bank and other centers of PGR activities. Detection of genetic constitution of germplasm, core sampling, germplasm characterization using molecular techniques.

HOFS – 812 BREEDING OF FRUIT CROPS 3(2+1)

Objective

To impart comprehensive knowledge about the principles and practices of breeding of fruit crops.

Theory

Origin and distribution, taxonomical status - species and cultivars, cytogenetics, genetic resources, blossom biology, breeding systems, breeding objectives, ideotypes, 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

UNIT I : Mango, banana and pineapple
UNIT II: Citrus, grapes, guava and sapota
UNIT III: Jackfruit, papaya, custard apple, aonla, avocado and ber
UNIT IV: Mangosteen, litchi, jamun, phalsa, mulberry, raspberry, kokam and nuts
UNIT V**:** Apple, pear, plums, peach, apricot, cherries and strawberry

Practical

Characterization of germplasm, blossom biology, study of anthesis, estimating fertility status, practices in hybridization, ploidy breeding, mutation breeding, evaluation of biometrical traits and quality traits, screening for resistance, developing breeding programme for specific traits, visit to research stations working on tropical, subtropical and temperate fruit improvement

HOFS – 813 POST HARVEST TECHNOLOGY FOR FRUIT CROPS 3(2+1)

Objective

To facilitate deeper understanding on principles and practices of postharvest management of fruit crops.

Theory

UNIT I Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration.

UNIT II

Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling.

UNIT III

Treatments prior to shipment, viz., chlorination, waxing, chemicals, bio-control agents and natural plant products. Methods of storage ventilated, refrigerated, MAS, CA storage, physical injuries and disorders.

UNIT IV

Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juices, beverages, pickles, jam, jellies, candies.

UNIT V

Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards.

Practical

Analyzing maturity stages of commercially important horticultural crops, improved packing and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables, estimation of transpiration, respiration rate, ethylene release and study of vase life extension in cut flower using chemicals, estimation of quality characteristics in stored fruits and vegetables, cold chain management - visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.