

## UG Syllabus Catered by Fruit Science Department

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### Semester-I

#### **HORT 101: Fundamentals of Horticulture**

**3 (2+1)**

##### **Theory**

Scope and importance, classification of horticultural crops and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery techniques and their management, soil and climate, vegetable gardens, nutrition and kitchen garden and other types of gardens – principles, planning and layout, management of orchards, planting systems and planting densities. Production and practices for fruit, vegetable and floriculture crops. Principles objectives, types and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water management– irrigation methods, merits and demerits, weed management, fertility management in horticultural crops-manures and fertilizers, different methods of application, cropping systems, intercropping, multi-tier cropping, mulching– objectives, types merits and demerits, Classification of bearing habits of fruit trees, factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, principles of organic farming, market chain management.

##### **Practical**

Features of orchard, planning and layout of orchard, tools and implements, identification of various horticultural crops, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

##### **Suggested Reading:**

- Prasad and Kumar, 2014. *Principles of Horticulture* 2<sup>nd</sup> Edn. Agrobios (India).  
Neeraj Pratap Singh, 2005. *Basic concepts of Fruit Science* 1<sup>st</sup> Edn. IBDC Publishers.  
Gardner/Bardford/Hooker. J.R., 1957. *Fundamentals of Fruit Production*. Mac Graw Hill Book Co., New York.  
Edmond,J.B, Sen,T.L, Andrews,F.S and Halfacre R.G., 1963. *Fundamentals of Horticulture*. Tata Mc Graw Hill Publishing Co., New Delhi.  
Kumar, N., 1990. *Introduction to Horticulture*. Rajyalakshmi publications, Nagarcoil, Tamilnadu  
Jitendra Singh, 2002. *Basic Horticulture*. Kalyani Publishers, Hyderabad.  
Denisen E.L.,1957. *Principles of Horticulture*. Macmillan Publishing Co., New York.  
Chadha,K.L.(ICAR),2002,2001. *Handbook of Horticulture*. ICAR, NewDelhi  
K.V.Peter, 2009. *Basics Horticulture*. New India Publishing Agency  
Kausal Kumar Misra and Rajesh Kumar, 2014. *Fundamentals of Horticulture*. Biotech Books.  
D.K. Salunkhe and S.S. Kadam, 2013. *A handbook of Fruit Science and Technology*. CRC Press.  
S. Prasad and U. Kumar, 2010. *A handbook of Fruit Production*. Agrobios (India).  
Jitendra Singh, 2011. *Basic Horticulture*. Kalyani Publications, New Delhi.

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### Semester-II

#### **HORT 151: Tropical and Subtropical Fruits**

**3 (2+1)**

##### **Theory**

Horticultural classification of fruits including genome classification. Horticultural zones of India, detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth

regulators, their solution preparation and use in commercial orchards. Physiological disorders, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, grapes, citrus, papaya, sapota, guava, , pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian, rambutan, bilimbi, loquat, rose apple breadfruit and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and casual factors and their management. Bud forecasting in grapes, sex expression and seed production in papaya, latex extraction and crude papain production, economic of production.

### **Practical**

Description and identification of varieties based on flower and fruit morphology in above crops. Training and pruning of grapes, mango, guava and citrus. Selection of site and planting system, pre-treatment of banana suckers, desuckering in banana, sex forms in papaya. Use of plastics in fruit production. Visit to commercial orchards and diagnosis of maladies. Manure and fertilizer application including bio-fertilizer in fruit crops, preparation and application of growth regulators in banana, grapes and mango. Seed production in papaya, latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits. Mapping of arid and semi-arid zones of India. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa, wood apple, West Indian cherry, tamarind, aonla, bael and annona.

### **Suggested Reading:**

H.P.Singh and M.M.Mustafa, 2009. *Banana*-new innovations. Westville Publishing House, New Delhi.

M.S.Ladaniya, 2013. *Citrus Fruits*. Elsevier, India post ltd.

Bose, T.K., Mitra, S.K. and Sanyal, D., 2002. *Tropical and Sub-Tropical-Vol-I*. Naya udyog-Kolkata Rajput, CBS and Srihari babu, R., 1985. *Citriculture*. Kalyani Publishers, New Delhi.

Chundawat, B.S., 1990. *Arid fruit culture*. Oxford and IBH, New Delhi.

Chadha,K.L. (ICAR) 2002, 2001. *Hand book of Horticulture*. ICAR, New Delhi.

Symmonds, 1996. *Banana*. II Edn. Longman, London.

Radha T and Mathew L., 2007. *Fruit crops*. New India Publishing Agency.

W S Dhillon, 2013. *Fruit Production in India*. Narendra Publishing House, New Delhi

T.K.Chattopadhyay, 1997. *Text book on pomology*. Kalyani Publishers, New Delhi.

R.E.Litz, 2009. *The Mango* 2<sup>nd</sup> Edn. Cabi Publishing, Willingford, U.K.

K.L.Chadda, 2009. *Advanced in Horticulture*. Malhotra Publishing House, New Delhi.

S.P. Singh, 2004. *Commercial fruits*. Kalyani Publishers, New Delhi.

F.S. Davies and L.G.Albrigo, 2001. *Citrus*, Cab International.

## **HORT 154: Plant Propagation and Nursery Management**

**2 (1+1)**

### **Theory**

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy types of dormancy (scarification & stratification) internal and external factors, nursery techniques nursery management, apomixes – mono-embryony, polyembryony, chimera & bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery (tools and implements), use of growth regulators in seed, types and stages of seed germination with examples and vegetative propagation, methods and techniques of division-stolons, pseudobulbs, offsets, runners, cutting, layering, grafting, formation of graft union, factor affecting, healing of graftage and budding physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Micrografting, meristem culture, callus culture, anther

culture, organogenesis, somaclonal variation hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery,

### **Practical**

Media for propagation of plants in nursery beds, potting and repotting. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting. Hardening plants in the nursery. Practicing different types of cuttings, layering, graftings and buddings including opacity and grafting, top grafting and bridge grafting etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labelling and packing of nursery fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their maintenance.. Nutrient and plant protection applications during nursery.

### **Suggested Reading:**

Hudson T. Hartmann, Dale E. Kester, Fred T. Davies, Jr. and Robert L. Geneve. *Plant Propagation-Principles and Practices (7<sup>th</sup> Edition)*. PHI Learning Private Limited, New Delhi-110001

T.K.Bose, S.K.Mitra, M.K.Sadhu, P. Das and D.Sanyal. *Propagation of Tropical & Subtropical Horticultural Crops, Volume 1 (3<sup>rd</sup> Revised edition)*. Naya Udyog, 206, Bidhan Sarani, Kolkata 700006.

Guy W. Adriance and Feed R. Brison. *Propagation of Horticultural Plants*. Axis Books (India).

S. Rajan and B. L. Markose (series editor Prof. K.V.Peter). *Propagation of Horticultural Crops-Horticulture Science Series vol.6*. New India Publishing Agency, Pitam Pura, New Delhi-110088.

Hartman, H.T and Kester,D.E.1976.*Plant Propagation Principles and practices*. Prentice hall of India Pvt.Ltd., Bombay.

Sadhu, M.K.1996. *Plant Propagation*. New age International Publishers, New Delhi.

Mukherjee,S.K. and Majumdar,P.K.1973.Propagation of fruit crops. ICAR, New Delhi.

Ganner,R.J. and Choudhri,S.A.1972.*Propagation of Tropical fruit trees*. Oxford and IBN publishing Co., New Delhi.

Sarma, R.R.2002. *Propagation of Horticultural Crops*. Kalyani Publishers,(Principles and practices) New Delhi.

Symmonds,1996. *Banana*. II edition Longman, London.

Chundawat, B.S. 1990.*Arid fruit culture*. Oxford and IBH, New Delhi.

Chadha,K.L. (ICAR)2002,2001.*Hand book of Horticulture*. ICAR, New Delhi.

## **HORT 155: Growth and Development of Horticultural Crops**

**2(1+1)**

### **Theory**

Growth and development-definitions, components, photosynthetic productivity, Canopy photosynthesis and productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, Crop development and dynamics (Case studies of annual/perennial horticultural crops), growth analysis in horticultural crops. Plant bio-regulators- auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering-factors affecting flowering, physiology of flowering, photoperiodism-long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning-source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of fruit growth and development, fruit setting, factors affecting fruit set and

development, physiology of ripening of fruits-climatic and non-climacteric fruits. Physiology of fruits under post-harvest storage.

### **Practical**

Estimation of photosynthetic potential of horticultural crops, leaf area index, growth analysis parameters including harvest index, bioassay of plant hormones, identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, seed dormancy, seed germination and breaking seed dormancy with chemicals and growth regulators.

### **Suggested Reading:**

- Salisbury, 2007. *Plant Physiology*. CBS. New Delhi.  
Taiz, L. 2010. *Plant Physiology*. SINAUR. USA.  
Zeiger. 2003. *Plant Physiology*. PANIMA. New Delhi.  
Edward E. Durna. 2014. *Principles of Horticultural Physiology*. CABI, UK.  
Delvin, R.M . 1986. *Plant Physiology*. CBS. Delhi.  
Richard, N. Arteca. 2004. *Plant Growth Substances*. CBS. New Delhi.  
Jacobs, W. P. 1979. *Plant Hormones And Plant Development*. Cambridge Univ. London.  
Basra, A. S. 2004. *Plant Growth Regulators In Agriculture & Horticulture*. HAWARTH press. New York.  
Lincoln Taiz and Edwards Zeiger (5<sup>th</sup> Edition). *Plant physiology*. Sinauer Associates, Inc.  
Noggle G.R and Fritz T.G.1944. *Introductory Plant Physiology*.  
Pandey and Sinha. *Plant Physiology*.  
JKA Bleasdale, *Plant Physiology in relation to Horticulture*  
Amarjit Basra, *Plant Growth Regulators in Agriculture and Horticulture: Their role & Commercial Uses*  
C.Rajendran, K. Ramamoorthy and S. Juliet Hepziba, *Nutritional and Physiological Disorders in Crop Plants*

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## **Semester-III**

### **HORT 201: Temperate Fruit Crops**

**2 (1+1)**

#### **Theory**

Classification of temperate fruits, detailed study of areas, production, varieties, climate and soil requirements, propagation, planting density, cropping systems, after care training and pruning, self-incompatibility and pollinisers, use of growth regulators, nutrient and weed management, harvesting, post-harvest handling and storage of apple, pear, peach, apricot, plum, cherry, persimmon, strawberry, kiwi, Queens land nut (Mecademia nut), almond, walnut, pecan nut, hazel nut and chest nut. Re-plant problem, rejuvenation and special production problems like pre-mature leaf fall, physiological disorders, important insect – pests and diseases and their control measures. Special production problems like alternate bearing problem and their remedies.

#### **Practical**

Nursery management practices, description and identification of varieties of above crops, manuring and fertilization, planting systems, preparation and use of growth regulators, training and pruning in apple, pear, plum, peach and nut crops. Visit to private orchards to diagnose maladies. Working out economics for apple, pear, plum and peach.

#### **Suggested Reading:**

- Chattopadhyay T.K.2009.*A text book on Pomology-IV Devoted to Temperate fruits*. Kalyani Publishers.B-1/292, Rajinder Nagar,Ludhiana-141008  
Banday F.A. and Sharma M.K.2010. *Advances in Temperate Fruit Production*. Kalyani Publishers. B-1/292, Rajinder Nagar, Ludhiana-141008.

- Kaushal Kumar Misra. 2014. *Text book of Advanced Pomology*. Biotech Books.4762-63, Ansari Road, Darya Ganj, New delhi-11002.
- Das B.C and Das S.N.*Cultivation of Minor Fruits*. Kalyani Publishers. B-1/292, Rajinder Nagar, Ludhiana-141008.
- Pal J.S.2010. *Fruit Growing* . 2010. Kalyani Publishers. B-1/292, Rajinder Nagar, Ludhiana-141008.
- Mitra S.K, Rathore D.S and Bose T .K. 1992. *Temperate Fruit Crops. Horticulture and Allied Publishers*, Calcutta.
- Chattopadhyaya, T.K. 2000. *A Text Book on Pomology (Temperate Fruits)* Vol. IV Kalyani Publishers, Hyderabad
- Chadha, T.R, 2001. *Text Book of Temperate Fruits*. Indian Council of Agricultural Research, New Delhi.
- David Jackson & N E Laone, 1999 *Subtropical and Temperate Fruit Production*. CABI, Publications.
- W S Dhillon. 2013. *Fruit Production In India*. Narendra Publishing House. New Delhi.

### Semester-IV

#### **HORT 251: Dry Land Horticulture**

**2(1+1)**

##### **Theory**

Definition, importance and limitation of dry land horticulture, present status and future scope. Constraints encounter in dry lands. Agro-climatic features in rain shadow areas, scarce water resources, high temperature, soil erosion, run-off losses etc.

Techniques and management of dry land horticulture. watershed development, soil and water conservation methods-terraces, contour bunds,etc. Methods of control and impounding of run-off water-farm ponds, trenches, macro catch pits,etc., *in-situ* water harvesting methods, micro catchment, different types of tree basins etc. Methods of reducing evapotranspiration, use of shelter belts, mulches, antitranspirants, growth regulators, etc. water use efficiency-need based, economic and conjunctive use of water, micro systems of irrigation etc.

Selection of plants having drought resistance. Special techniques, planting and after care-use of seedling races, root stocks, *in-situ* grafting, deep pitting/planting, canopy management etc.

Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.

##### **Practical**

Study of rainfall patterns. Contour bunding/trenching, micro catchments, soil erosion and its control. Study of evapotranspiration, mulches and micro irrigation systems. Special techniques of planting and aftercare in dry lands. Study of morphological and anatomical features of drought tolerant fruit crops.

##### **Suggested reading:**

Chundawat, B.S. 1990. *Arid Fruit Culture*. Oxford and IBH, New Delhi.

P.L. Taroj, B.B. Vashishtha, D.G.Dhandar. 2004. *Advances in Arid Horticulture*. Internal Book Distributing Co., Lucknow.

T. Pradeep Kumar, B. Suma, Jyothi Bhaskar and K.N. Sathesan. 2008. *Management of Horticultural Crops*. New India Publishing Agency.

#### **HORT 254: Breeding of Fruit and Plantation Crops**

**3 (2+1)**

##### **Theory**

Fruit breeding - History, importance in fruit production, distribution, domestication and adaptation of commercially important fruits, variability for economic traits, breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – *in vitro* breeding tools (important fruit and plantation crops).

### **Practical**

Exercises on floral biology, pollen viability; emasculation and pollination procedures; hybrid seed germination; raising and evaluation of segregating populations; use of mutagens to induce mutations and polyploidy in major crops like Mango, Banana, Citrus, Grapes, Guava, Sapota, Papaya, Custard apple, Aonla, Ber, Litchi, Pomegranate, Jamun, Arecanut, Coconut, Pistachio nut, Apple, Pear, Plum, Peach, Apricot and Strawberry.

### **Suggested Reading:**

Nijar 1985. *Fruit breeding in India*, Oxford & IBH Publishing Co. New Delhi  
Anil Kumar Shukla 2004. *Fruit breeding approaches & Achievements*. International Book Distributing Co. New Delhi.  
Kumar, N. 1997. *Breeding of Horticultural Crops, Principles and Practices*. New India Publishing Agency, New Delhi.  
Singh, B.D. 1983. *Plant Breeding Principles and methods*. Kalyani Publishers, New Delhi.

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## **Semester-V**

### **HORT 301: Orchard and Estate Management**

**2(1+1)**

#### **Theory**

Orchard & estate management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches. Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems. Biological efficiency of cropping systems in horticulture, systems of irrigation. Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties. Factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, Integrated nutrient and pest management. Utilization of resources constraints in existing systems. Crop model and crop regulation in relation to cropping systems. Climate aberrations and mitigation measures of Horticultural crops.

#### **Practical**

Layout of different systems of orchard and estate, soil management, clean, inter, cover and mixed cropping, fillers. Use of mulch materials, organic and inorganic, moisture conservation, weed control. Layout of various irrigation systems.

#### **Suggested Reading:**

Kumar, 1990. *Introduction to Horticulture crops*. Rajyalakshmi Publications, Nagercoil, Tamilnadu.  
Palaniappan, S.P. and Sivaraman, K. 1996. *Cropping systems in the Tropics*. New age International (P) Ltd., Publishers, New Delhi.  
Shanmugavelu, K.G. 1989. *Production Technology of Fruit Crops*. Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.  
WS. Dhillon and Bhatt. 2011. *Fruit Tree Physiology*. Narendra Publishing House, New Delhi.  
B .C. Mazumdar. 2004. *Principles and Methods of Orchard Establishment*. Daya Publishing House, New Delhi.  
T. Pradeep Kumar, B. Suma, Jyothi Bhaskar and K.N.Satheson. 2008. *Management of Horticultural Crops*. New India Publishing Agency, New Delhi.  
B .C. Mazumdar. 2004. *Orchard Irrigation and Soil Management Practices* Daya Publishing Agency, New Delhi. Daya Publishing Agency, New Delhi

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## UG Syllabus of Agriculture Catered by Horticulture Faculty as well as FSC

### Semester-I

#### **HORT (A) 107: Fundamentals of Horticulture 2 (1+1)**

##### **Theory**

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

##### **Practical**

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

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### Semester-IV

#### **HORT (A) 259: Production Technology for Fruit and Plantation Crops 2 (1+1)**

##### **Theory**

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

##### **Practical**

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.