



## 2. B.Sc. (Hort.) FIRST YEAR SECOND SEMESTER

- a. **Environmental Science [ESC 121]**  
**3 (2+1)**

### **Theory:**

Environment: introduction, definition and importance. Components of environment - interactions with organisms. Global and Indian environment - past and present status. Environmental pollution and pollutants. Air, water, food, soil, noise pollution - sources, causes and types. Smog, acid rain, global warming, ozone hole, eutrophication, sewage and hazardous waste management. Impact of different pollutions on humans, organisms and environment. Introduction to biological magnification of toxins. Deforestation - forms and causes, relation to environment. Prevention and control of pollution - technological and sociological measures and solutions - Indian and global efforts. India, international and voluntary agencies for environmental conservation - mandates and activities. International conferences, conventions and summits - major achievements. Environmental policy and legislation in India. Introduction to environmental impact assessment. Causes of environmental degradation - socio-economic factors. Human population growth and lifestyle.

### **Practical:**

Visit to local areas - river/forest/ grassland/catchment etc. to document components of ecosystem. Study of common plants, insects, birds and animals. Visit to industries to study pollution abatement techniques.

### **Reference Books:**

1. Agarwal, S.K. (2002). Environmental Biotechnology. APH. Publishing Corporation. New Delhi.
2. Biswas, Sas. (2006). Indian Biodiversity to the Present Millennium: Global Prospects and Perspectives. Satish Serial Publishing House. Delhi
3. Chowdhery, H.J. and Murti, S.K. (2000). Plant Diversity and Conservation: An Overview.
4. Bishan Singh Mahendrapal Singh Publ. Dehradun.



5. Gangopadhyay, A. (2007). Plant Biodiversity. Gene-tech Books, New Delhi.
6. Negi, S.S. (2008). A Hand book of Environmental Science. Bishan Singh Mahendrapal Singh Publ. Dehradun,
7. Sharma, P.D. (2008). Ecology and Environment. 10<sup>th</sup> Revised ed. Rastogi Publication. Meerut.
8. Singh, K. and Shishodia, A. 2007 Environmental Economics: Theory and Applications Saga Publ. New Delhi Los Angeles, Publ. London. Singapur
9. Thakur V. 2012. Environmental Science. Scientific Publishers. Jodhpur.

**b. Fundamentals of Food Technology [PHM 121]  
2(1+1)**

**Theory:**

Food and its function, physico-chemical properties of foods, food preparation techniques, nutrition, relation of nutrition of good health. Characteristics of well and malnourished population. Energy, definition, determination of energy requirements, food energy, total energy needs of the body. Carbohydrates: classification, properties, functions, source, requirements, digestion, absorption and utilization. Protein, classification, properties, functions, sources, requirements, digestion, absorption, essential and non-essential amino acids, quality of proteins, PER/NPR/NPU, supplementary value of proteins and deficiency. Lipids-classification, properties, functions, sources, requirements, digestion, absorption and utilization, saturated and unsaturated fatty acids, deficiency, rancidity, refining of fats. Mineral nutrition: macro and micro-minerals (Ca, Fe and P), function, utilization, requirements, sources, effects of deficiency. Vitamins: functions, sources, effects of deficiency, requirements of water soluble and fat-soluble vitamins. Balanced diet: recommended dietary allowances for various age groups, assessment of nutritional status of the population.

**Practical:**

Methods of measuring food ingredients, effect of cooking on volume and weight, determination of percentage of edible portion. Browning reactions of fruits and vegetables. Microscopic examination of starches, estimation of energy, value proteins and fats of foods. Planning diet for various age groups.

**c. Growth and Development of Horticultural Crops [PP 121]  
2(1+1)****Theory:**

Growth and development-definitions, components, photosynthetic productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, growth analysis in horticultural crops. Plant bioregulators- 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.

**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, rapid tissue test, seed



dormancy, seed viability by tetrazolium test, seed germination and breaking seed dormancy with chemicals and growth regulators.

**Reference Books:**

1. Buchanan, B.Gruinessam, W. & Jones, R. (2002). Biochemistry & Molecular Biology of Plant, John Wiley & Sons.
2. Epstein, E. (1972). Mineral Nutrition of plants: Principles and Perspectives.
3. Jacobs, W.P. (1979). Plant Hormones and Plant Development. Cambridge University Press, Cambridge.
4. Leopold, A.C. & Kriederman, P.E. (1985). Plant Growth and development. 3rd Ed. M.C Graw-Hill.
5. Naidu C.K. (2004). Plant Growth and Development. Pointer Publishers. Jaipur.
6. Peter, K.V. (2008) (Ed.) Basics of Horticulture, New India Publ. Agency.
7. Roberts, J. Downs, S. & Parker, P. (2002). Plant Growth Development In: Plants (I. Ridge, Ed.) Oxford University Press.
8. Salisbury, F.B. & Ross, C.W. (1992). Plant Physiology, 4th ed. Wadsworth publ.
9. Wiley, Fosket D.E. (1994). Plant Growth and Development: a Molecular Approach. Academic Press.

**d. Plant Propagation and Nursery Management [FSC 121]  
2(1+1)**

**Theory:**

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy (scarification & stratification) internal and external factors, nursery techniques, apomixes-monoembryony, polyembryony, chimera & bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, nursery (tools and implements), use of growth regulators in seed and vegetative propagation, methods and techniques of cutting, layering, grafting and budding physiological & bio chemical basis of rooting, factors



influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers. Micrografting, hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery.

**Practical:**

Media for propagation of plants in nursery beds, pot and mist chamber. 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, grafting and budding including opacity and 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, labeling and packing of 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. Top grafting, bridge grafting and nursery management. Nutrient and plant protection applications during nursery.

**Reference books:**

1. Hudson T. Hartmann, Dale E. Kester, Fred T. Davies, Robert L. Geneve (2004). Plant Propagation Principles & Practices. Prentice- Hall of India PVL New Delhi.
2. Maiti, R.C. (2005). Plant propagation at a glance. Kalyani Publishers, Rajendra Nagar Ludhiana.
3. Sharma, R.R. and Shrivastava, Manish (2004). Plant propagation and Nursery Management. International Book Distributing Co., Lucknow, India.
4. Bharadwaj, R.L. and Sarolia, D.K (2011). Modern Nursery Management. AGROBIOS, Jodhpur (Raj.).



5. Sharma, R.R. (2005). Propagation of Horticultural Crops (Principles & Practices). Kalyani Publishers, Rajendra Nagar Ludhiana.
6. Rajan, S. and Markose, B.L (2007). Propagation of horticulture Crops. International book and Periodicals supply services. New Delhi.
7. Andriance, Guy W. (2008). Propagation of Horticulture Plants. International book and Periodicals supply services. New Delhi.

**e. Principles of Plant Breeding [PBG 121]  
3 (2+1)**

**Theory:**

Plant breeding as a dynamic science, genetic basis of Plant Breeding - classical, quantitative and molecular, Plant Breeding in India - limitations, major achievements, goal setting for future. Sexual reproduction (cross and self pollination), asexual reproduction, pollination control mechanism (incompatibility and sterility and implications of reproductive systems on population structure). Genetic components of polygenic variation and breeding strategies, selection as a basis of crop breeding. Hybridization and selection - goals of hybridization, selection of plants; population developed by hybridization - simple crosses, bulk crosses and complex crosses. General and special breeding techniques. Heterosis - concepts, estimation and its genetic basis.

**Practical:**

Breeding objectives and techniques in major field crop plants. Floral biology - its measurement, emasculation, crossing and selfing techniques in major crops. Determination of mode of reproduction in crop plants, handling of breeding material and maintenance of experimental records in self and cross pollinated crops. Demonstration of hybrid variation and production techniques.

**Reference Books:**

1. Singh, B.D. Plant Breeding.
2. Sharma, J.R. Principles and Practices of Plant Breeding.
3. Poehlman, J.M. and Sleper, D.A. Breeding field crops.



4. Choudhary, R.C. Principles of Plant Breeding
5. Singh, Dr. Phundan Plant breeding. Kalyani Publisher
6. Choudhary, H.K. Elementary Principle of Plant Breeding
7. Sharma, A.K. Breeding Technologies of Crop Production.
8. Stoskopf. Plant Breeding: Theory and Practical.
9. Allard John Wiley, R.W. & Sons. Principle of plant breeding. Inc. New York.
10. Plant breeding- V.L. Chopra Oxford and IBH Pvt. Ltd. New Delhi.
11. Plant breeding molecular and new approaches- Phundan Singh Kalyani Publisher, New Delhi.

## 2.6 Soil Fertility and Nutrient Management [SAC 121] 2(1+1)

### Theory:

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements - functions, deficiency systems, transformations and availability. Acid, calcareous and salt affected soils characteristics and management. Role of microorganisms in organic matter- decomposition - humus formation. Importance of C:N ratio and pH in plant nutrition. Integrated plant nutrient management. Soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions, deficiency symptoms, visual diagnosis.

### Practical:

Analysis of soil for organic matter, available N,P,K and Micronutrients and interpretations. Gypsum requirement of saline and alkali soils. Lime requirement of acid soils.

### Reference Books:

1. Samuel L. Tisdale and Werner L. Nelson. Soil fertility and Fertilizers. Macmillan Publishing co. Inc. New Yoark.
2. Kalelswari, R.K. Hand Book of soil fertility. SSPH India



3. Shrivastawa, V.C. Management of problem soil Principal & practice. Agrobiose Jodhpur.
4. Masih, A.J. Soil and Fertilizers. S.S.P.H. New Delhi
5. Kashyap, R.K. Soil Fertility and Integrated Nutrient management. Oxford Publications New Delhi
6. Russel. Soil Condition and Plant Growth. Biotech Publication Udaipur

## 2.7 Tropical and Sub-Tropical Fruits [FSC 122] 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. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, bael, grapes, citrus, papaya, sapota, guava, pineapple, jackfruit, avocado, mangosteen, litchi, *Carambola*, durian 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, economics of production. Rain fed horticulture, importance and scope of arid and semi-arid zones of India. 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:

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, de-suckering in banana, sex forms in papaya. Use of plastics in fruits 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.

**Reference books:**

1. Chattopadhyay, T.K (2005). A Text book of Pomology Vol-II Tropical Fruits. Kalyani Publishers, Rajendra Nagar, Ludhiana.
2. Chattopadhyay, T.K (2007). A Text book of Pomology Vol-III, Sub tropical Fruits. Kalyani Publishers, Rajendra Nagar, Ludhiana.
3. Maiti, R.G., Das, P.C. (2007). Fruit Crops of India. Kalyani Publishers, Rajendra Nagar, Ludhiana.
4. Yadav, P.K. (2007). Fruit Production Technology. International book Distributing Co., Lucknow.
5. Sharma, R.R. (2007). Fruit Production: Problems & Solutions. International book Distributing Co., Lucknow.
6. Bose, T.K., Mitra, S.K & Sanyal, D. (2002). Fruits: Tropical & Subtropical Vol. II, Naya Udyog, 206 Bidhan Sarai, Calcutta.
7. Radha, T. & Mathew, L. (2007). Fruit crops. International book & Periodicals supply Services, New Delhi.
8. Bal, J.S. (2006). Fruit Growing. Kalyani Publishers, Rajendra Nagar, Ludhiana.
9. Chattopadhyay, T.K (2000). A Text book of Pomology Vol-IV, Temperate Fruits. Kalyani Publishers, Rajendra Nagar, Ludhiana.
10. Chadha, T.R. (2002) Textbook of Temperate fruits, ICAR New Delhi.
11. Mitra, S.K., Rathore, D.S. and Bose, T.K. (2003) Temperate Fruits. Horticulture & allied Publisher Calcutta. India.

**2.8 Tropical and Sub-Tropical Vegetables [VSC 121]**

**3(2+1)**

**Theory:**

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted



vegetable crops. Spacing, planting systems water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield and seed production. Economics of cultivation of tropical and sub-tropical vegetable crops; post-harvest handling and storage. Marketing of tomato, brinjal, chillies, okra, *Amaranthus*, cluster beans, cowpea, lab-lab, snap bean, cucurbits, *Moringa*, curry leaf, *Portulaca* and *Basella*.

**Practical:**

Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and intercultural; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation.

**Reference books:**

1. Bose, T. K. and Som, M.G. (1986). Vegetable Crops in India. Naya Prokash, Calcutta-6
2. Singh, S.P. (1989). Production Technology of Vegetable Crops. ARCC, Sadar Karnal
3. Chadha, K.L. (2001). Hand Book of Horticulture. ICAR, New Delhi
4. Thamburaj, S. and Singh, Narendra (2003). Text Book of Vegetables, Tuber Crops and Spices. ICAR, New Delhi.
5. Gopalakrishnan, T.R. (2007). Vegetable Crops. Vol 04 Horticulture Science Series, New India Publishing Agency, Pitam Pura, New Delhi - 110088 .
6. Hazra, P., Chattopadhyay, A., Karmakar, K. and Dutta S. (2011). Modern Technology in Vegetable Production. NIPA, New Delhi
7. Mourya, K.R. (2012). " Bharat Ki Salad Phasalien" Satish Serial Publishing House, Azadpur, Delhi



## 2.9 Water Management in Horticultural Crops [AGRO 121]

2(1+1)

### Theory:

Importance of water, water resources in India. Area of different crops under irrigation, function of water for plant growth, effect of moisture stress on crop growth. Available and unavailable soil moisture - distribution of soil moisture - water budgeting - rooting characteristics - moisture extraction pattern. Water requirement of horticultural crops - lysimeter studies - Plant water potential climatological approach - use of pan evaporimeter - factor for crop growth stages - critical stages of crop growth for irrigation. Irrigation scheduling - different approaches - methods of irrigation - surface and sub-surface pressurized methods viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water. Water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops. Layout of different irrigation systems, drip, sprinkler. Layout of underground pipeline system.

### Practical:

Measurements of irrigation water by using water measuring devices, use of common formula in irrigation practices, practicing of land leveling and land shaping implements, layout for different methods of irrigation. Estimation of soil moisture constants and soil moisture by using different, methods and instruments, scheduling of irrigation, different approaches, practicing use of instruments, estimation of irrigation efficiency and water requirements of horticultural crops, irrigation planning and scheduling, soil moisture conservation practices.

### Reference Books:

1. Michael, A.M. Irrigation theory and Practices
2. Srelson, I. Irrigation Engineering.
3. Shivannauppam, RK. Design of Sprinkler irrigation.
4. Karmeli. Manual of drip irrigation
5. Datta, N.K. Soil conservation and land development