



## **DIPLOMA IN HORTICULTURE**

Course Name: Diploma in Horticulture

Duration: 1 Year

Eligibility: 10 or Equivalent from recognized board

### **DETAILED SYLLABUS**

<b>Semester I</b>	<b>Semester II</b>
Basics in Horticulture	Production Technologies of Fruit Crops
Plant Propagation and Nursery Management	Ornamental Gardening and Landscaping
Fundamentals of Agronomy	Production Technologies of Vegetable Crops
Soils and Fertility Management for Horticultural Crops	Basics in Plant Pathology
Soil and Applied Microbiology	Farm Machinery for Horticultural Crops

## SEMESTER I

### **PAPER 1: BASICS IN HORTICULTURE**

#### **CONTENT:**

**Unit 1:** Scope and Importance of Horticulture-Scope and importance of horticultural crops, divisions of horticulture, area and production, export and import, global scenario, classification of horticultural crops, nutritive value, horticultural zones of India and Tamil Nadu – research institutes related with development of horticulture.

**Unit 2:** Establishment of Orchard and Factors Influencing Crop Production-Establishment of orchard, principles, planning and layout, different planting systems, factors limiting horticultural crop production, manures and manuring, weed management, irrigation methods, influence of soil, physical and chemical properties and climatic factors, light, temperature, photoperiod, relative humidity, rainfall, micro climate and pollution.

**Unit 3:** Nursery Management and Cropping Systems-Nursery techniques, vegetable garden, nutrition garden, kitchen garden and other types of gardens, cropping systems, intercropping, multi, tier cropping, cover cropping, planting methods, mulching, principles of organic farming.

**Unit 4:** Growth and Development-Bearing habits, flowering, pollination and fruit set, unfruitfulness, fruit drop, causes and prevention, training and pruning, use of growth regulators rejuvenation of old orchards.

**Unit 5:** Protected Cultivation and Post Harvest Technology-Basics of protected cultivation, green house components, structure for environmental control, post, harvest technology, importance and causes for post, harvest losses, maturity indices, harvesting methods.

#### **PRACTICAL**

1. Study of different features of orchard.
2. Planning, layout and planting of fruit trees.
3. Identification of tools and implements.
4. Preparation of nursery beds and sowing vegetable seeds and transplanting of vegetable crops.
5. Practicing training of fruit trees.
6. Practicing pruning of fruit trees.
7. Identification of growth regulators – preparation and application.
8. Preparation of fertilizer mixtures and field application.
9. Practicing weeding including chemical weed control.
10. Layout of different irrigation systems and irrigation methods.
11. Study of bearing habits of horticultural crops.
12. Study of different structures for protected cultivation.
13. Study of different media for protected cultivation.
14. Practice in judging the maturity indices of fruits and vegetables.
15. Study of harvesting methods.
16. Visit to green houses.

## **Suggested Readings**

1. Chadha, K.L. 2002. Hand book of Horticulture, ICAR, New Delhi.
2. Jitendra Singh 2006. Basic Horticulture. Kalyani Publishers, New Delhi.
3. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.
4. Kushal Kumar Misra and Rajesh Kumar.2014. Fundamentals of Horticulture. Biotech Books.
5. Peter, K.V. 2014. Basic of Horticulture. New India Publishing Agency.
6. Pradeep Sinha. 2014. Text Book of Horticulture. Sublime Publications.
7. Vijayakumar U.M. Rao.2008. Horticulture terms – Definition and terminology. IBD Publishers

## **PAPER 2: PLANT PROPAGATION AND NURSERY MANAGEMENT**

### **CONTENT:**

**Unit 1:** Methods of Propagation-Scope and importance, propagation, overview, methods of sexual and asexual propagation, advantages and disadvantages of sexual and vegetative propagation.

**Unit 2:** Principles and Methods of Seed Propagation-Seed propagation, seed dormancy – internal and external factors, nursery techniques, protray culture, apomixes, monoembryony, polyembryony, principles, utilization.

**Unit 3:** Propagation Structures-Propagation structures – mist chamber – cold frames – hot beds – humidifiers– green houses – glass houses – tools and implements – use of growth regulators in seed and vegetative propagation – physiological and anatomical basis of vegetative propagation.

**Unit 4:** Asexual Propagation Techniques-Methods and techniques of cuttings, layering, grafting and budding – factors influencing rooting of cuttings, layering, budding, grafting – stock scion relationship– root stock influences – Propagation through specialized organs – tuber, bulb, corm, bulbils, rhizome, runner, offshoot, crown, slips and sucker.

**Unit 5:** Micro Propagation-culture media, culture conditions, meristem culture, callus culture, micro grafting, hardening of plants in nurseries, clonal orchards, nursery registration act.

### **PRACTICAL**

1. Preparation of nursery bed, seed treatment and sowing.
2. Identification of various tools and implements.
3. Preparation of pot mixture and study of various containers.
4. Practices in potting, repotting and liquid manures.
5. Study of special structures for propagation viz., mist chamber, cold frames, hot beds, poly house, shade net house.
6. Raising of rootstocks and scion preparation.
7. Mist propagation techniques.
8. Practice in propagation by cuttings.
9. Practice in propagation by layering.
10. Practice in propagation by budding.
11. Practice in propagation by grafting.
12. Use of growth regulators in propagation.
13. Practices in separation and description of plant parts used for propagation.
14. Rejuvenation, top working and bridge grafting.
15. Practice in micro propagation and hardening methods.
16. Visit to tissue culture laboratory and controlled green houses and project preparation for commercial nurseries and visit to private nurseries.

## **Suggested Readings**

1. Bose, T.K., S.K. Mitra, M.K. Sadhu and B. Mitra. 1991. Propagation of Tropical and subtropical Horticultural Crops. Naya Prakash 206, Bidhan Sarani, Calcutta, Six. India.
2. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 1997. Plant propagation – Principles and Practices. Prentice Hall of India Private Ltd., New Delhi.
3. Peter, K.V. S. Rajan and Baby Lissy Markose. 2007. Propagation of Horticultural Crops. Horticulture Science Series-6. New India Publishing Agency.
4. Singh, R.S., R. Bhagava. 2014. Propagation of Horticultural Plants – Arid and Semi – Arid Regions. New India Publishing Agency.
5. Reddy, Y.T.N., T. Janakiram and D. Satyanarayana Reddy. 2001. Scientific Nursery Management. The House of Sarpan (Media), Bangalore.
6. Prasad, S. and V. Kumar. 1999. Green House Management of Horticultural Crops. Agrobios India, Jodhpur.

## **PAPER 3: FUNDAMENTALS OF AGRONOMY**

### **CONTENT:**

**Unit 1:** Introduction to Agriculture and Agronomy-Agriculture, definition, scope of agriculture in India and Tamil Nadu, branches of agriculture, Agronomy, art, science and business of crop production. Agronomical classification of crops, their importance, Major crops of India and Tamil Nadu. Factors affecting crop production, moisture, aeration, light, temperature and nutrients.

**Unit 2:** Basic Agricultural Operations-Basic principles of agricultural operations, tillage and tith, objectives and types of tillage primary tillage, secondary tillage and intercultural operations. Modern concepts of tillage. Implements and tools used in agriculture, seeds and sowing, seed treatment, Nursery, Transplanting. Cropping systems, definitions, principles.

**Unit 3:** Cultural Practices for Crops-Plant population and crop geometry. After cultivation, gap filling and thinning, Weeding and irrigation. Manures, organic manures, green manures, biofertilizers. Fertilizers, Methods of application, basal, split and foliar application. Organic farming, sustainable agriculture, definition, concepts. Meteorology, agricultural meteorology, definition, importance in Crop Production.

**Unit 4:** Dry Farming Management-Dry farming, definition, classification. Drought, definition, effects of drought on crop production, Drought management, Contingent crop planning. Soil moisture conservation approaches.

**Unit 5:** Watershed Management-definition, concepts, scope and importance. Water harvesting, farm pond, percolation pond.

### **PRACTICAL**

1. Identification of crops in low land, irrigated uplands and dryland.
2. Preparation of cropping scheme for different ecosystem.
3. Acquiring skill in the use of primary and secondary tillage implements.
4. Practicing the use of special purpose implements (puddler, rotary weeders and cono-weeder).
5. Skill learning and practicing nursery bed preparation for low lands and irrigated uplands.
6. Practicing main field preparation.
7. Seed treatment techniques.
8. Practicing sowing and transplanting.
9. Practicing manual weeding and spraying of herbicides with different formulations.
10. Practicing application of organic, inorganic, green manures and biofertilizers.
11. Inorganic fertilizers – identification of fertilizers – calculation based on fertilizer schedule.
12. Visiting Agro met observatory and getting acquaintance with instruments.
13. Soil erosion and soil conservation practices. Water harvesting structure and their use.
14. Drought management technologies to mitigate drought in dryfarming agriculture.
15. Preparation of contingency crop plan for aberrant rainfall situations.

16. Visit to watershed area to study the impact of various soil and moisture conservation methods.

### **Suggested Readings**

1. Sankaran, S. and V.T. Subbiah Mudaliar. 1997. Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
2. Gopaldaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur.
3. Balsubramanian, P. and SP. Palaniappan, 2010. Principles and Practices of Agronomy. Agrobios. Jodhpur – 342 002.
4. Panda S.C. 2010. Agro Meteorology and Contingent Crop Planning. Agrobios (India), Jodhpur.
5. Sudhagar Rao, G.B, M. Thirupathi, C. Ravikumar and K.P. Senthilkumar, 2015. Basic Agronomy, Manibharathi Publication, Tamil Nadu.

## **PAPER 4: SOILS AND FERTILITY MANAGEMENT FOR HORTICULTURAL CROPS**

### **CONTENT:**

**Unit 1:** Soil Physical Properties-Soil definition, it's major components, soil physical properties, soil texture, soil structure, bulk density, particle density, porosity, soil consistency, soil color soil water, soil air, soil temperature, their significance on crop production.

**Unit 2:** Soil Chemical Properties-Soil chemical properties, pH, EC, organic carbon, it's influence on soil properties, soil organic matter, composition, decomposition, carbon cycle, nitrogen cycle, soil micro, organisms.

**Unit 3:** Soil Fertility and Productivity-Soil fertility, definition, types, evaluation methods, soil productivity, definition, soil testing, definition, objectives, STL, functions, soil test based fertilizer recommendation, Soils of Tamilnadu, INM, IPNS, FUE.

**Unit 4:** Manures and Fertilizers – definition, differences, classification – major nutrient fertilizers, N, P, K fertilizers, secondary and micronutrient fertilizers, complex and mixed fertilizers, losses of nutrients from soil, biofertilizers, plant growth regulators, Preparation of Enriched farm yard manure and micro nutrient mixtures.

**Unit 5:** Problem Soils and Irrigation Water-Problem soils, soil physical constraints, their management, soil chemical constraints acid soil, saline soil, alkali soil, calcareous soil, formation, characteristics, reclamation, irrigation water, testing, quality indices, management of poor quality water.

### **PRACTICAL**

1. Study of different soil types.
2. Soil sampling – skill learning in collection and processing.
3. Determination of soil texture by feel method.
4. Estimation of soil bulk, density particle density & pore space by measuring cylinder method.
5. Estimation of soil moisture by hot air oven – dry method.
6. Estimation of soil pH and EC.
7. Qualitative tests of manures, fertilizers and bio – fertilizers.
8. Calculation of fertilizer doses for different crops.
9. Foliar application of fertilizer nutrients.
10. Foliar application of growth regulators.
11. Identification of nutrient deficiency, toxicity symptoms in crops.
12. Preparation of enriched farm yard manure.
13. Preparation of micronutrient mixtures.
14. Visit to compost preparation unit.
15. Estimation of pH, EC in irrigation water.



16. Interpretation of irrigation water quality using analytical data.

### **Suggested Readings**

1. John Havlin, James Beaten, Samuel Tisdale, Werner Nelson. 2005. Soil Fertility and Fertilizers – An Introduction to Nutrient Management. 7th Edition, Prentice Hall. Upper Saddle River, NJ.
2. Kanwar, J.S. 1976. Soil fertility – Theory and Practice. ICAR, New Delhi.
3. Mengel, K. and E.A. Kirkby. 1987. Principles of Plant Nutrition. 4th Edition, International Potash Institute, Worblaufen – Bern, Switzerland.
4. Horst. 1995. Mineral Nutrition of Higher Plants. 2nd Edition. Marschner, Academic Press, Inc. San Diego, CA.

## **PAPER 5: SOIL AND APPLIED MICROBIOLOGY**

### **CONTENT:**

**Unit 1:** History Developments in Microbiology & Occurrence of Microorganisms-History developments in microbiology, contributions of Beijerinck, Winogradsky, Fleming and Waksman, Distribution and importance of soil microorganisms, Factors affecting the occurrence and activities of soil Microorganisms.

**Unit 2:** Transformation of Carbon & Nitrogen in Soil-Carbon and nitrogen cycle in nature, mineralization, ammonification, nitrification, denitrification and biological nitrogen fixation: Symbiotic and non, symbiotic microorganism, process of nitrogen fixation.

**Unit 3:** Rhizosphere Microorganisms and its Importance-Microbial transformation of Phosphorus, Rhizosphere and its importance in crop Plants, R: S ratio, microbial interrelationship in soil, beneficial and harmful relationships.

**Unit 4:** Bio fertilizers – Production & Quality Control-Bacterial Bio Fertilizers Rhizobium, Azospirillum, Azotobacter, Gluconacetobacter, Azorhizobium and phosphobacteria, plant growth promoting rhizobacteria (PGPR), Fungal bio fertilizers. Ecto and endomycorrhizae, Algal bio fertilizers: Blue green algae and Azolla, Production and quality control of Bio fertilizers.

**Unit 5:** Application and Uses of Microorganisms in Different Fields-Industrial utilization of microorganisms associated with food and dairy products. Microbes in pest and disease management. *Bacillus thuringiensis* *Trichoderma viride*, *Beauveria*, *Verticillium*, *Metarrhizium*.

### **PRACTICAL**

1. Conn's direct microscopic count of estimating soil microbial population.
2. Standard plate count of soil microorganism or Dilution plate technique.
3. Buried slide technique.
4. Isolation of Root nodule bacterium – Rhizobium.
5. Isolation and purification of Azotobacter.
6. Isolation and purification of Azospirillum.
7. Isolation and purification *Gluconacetobacter diazotrophicus*.
8. VAM Staining.
9. Isolation and purification of phosphobacteria.
10. Identification of endomycorrhizal fruiting bodies.
11. Isolation and purification of Blue Green Algae.
12. Bacterial Bio fertilizer inoculants production.
13. Methods of application of bio fertilizer and Quality control.
14. Mass production of fungal bio fertilizer.
15. Estimation of rhizosphere microbial population a working out R: S ratio.

16. Isolation and estimation of microorganisms from spoiled dairy products.

### **Suggested Readings**

1. Alexander, M. 1985. Introduction to Soil Microbiology, John Wiley & Sons, New York.
2. Rangaswami, G. and Bagyaraji, D.J. 1992. Agricultural Microbiology. Asia Publishing House, New Delhi.
3. Subba Rao, N.S., 1995. Soil Microorganism and Plant Growth. Oxford & IBH New Delhi.
4. Subba Rao, N.S., 1994. Biofertilizers in Agriculture and Agroforestry. Oxford & IBH New Delhi.
5. Soil Microbiology, Ecology and Biochemistry. 4th Edn. Eldor Paul (Ed) Academic press Nov. 2014
6. Elsas, Jansson and Trevorr (EDS) 2006. Modern Soil Microbiology. 2nd edn CRC press.
7. Roy A. K 2007. Rhizosphere Biotechnology: Plant Growth Retrospect and Prospect. Scientific Publishers (India), Jodhpur.

## **SEMESTER II**

### **PAPER 1: PRODUCTION TECHNOLOGIES OF FRUIT CROPS**

#### **CONTENT:**

**Unit 1:** Importance of Pomology-Definition, area and production of fruit crops in Tamil Nadu, orchard management, definition, selection and layout of orchard, physical features in orchard.

**Unit 2:** Production Technology – I-Study of cultural practices of the following fruit crops with reference to soil, climate, varieties, methods of propagation, nutrient, irrigation and weed management practices, training and pruning, role of growth regulators – maturity standards for harvesting, post harvest technology of fruit crops, yield, grading, packing, storage and value added products. Mango, Banana, Grapes, Papaya and Aonla.

**Unit 3:** Production Technology – II-Sapota, Guava, Citrus, Jack, Pineapple and Avocado.

**Unit 4:** Production Technology – III- Apple, Pear, Plum and Peach

**Unit 5:** Organic Production and GAP in Fruit Crops-Organic fruit production and Good Agricultural Practices in fruit crops

#### **PRACTICAL**

1. Selection and layout of orchard and physical features in orchard.
2. Different planting systems in fruit crops.
3. Practices in mango propagation.
4. Practicing pruning in mango.
5. Practicing top working and rejuvenation of senile mango orchards.
6. Practicing sucker treatment for banana and planting.
7. Practices in grapes propagation.
8. Practicing training in grapes.
9. Practicing pruning in grapes.
10. Nursery practices for papaya.
11. Practicing papain extraction from Papaya.
12. Practices in sapota propagation.
13. Practices in guava propagation.
14. Nursery practices for citrus.
15. Irrigation management in fruit crops.
16. Working out cost economics of cultivation of fruit crops.

#### **Suggested Readings**

1. Chattopadhyay, T.K. 2007. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.
2. Radha, T. and L. Mathew. 2007. Fruit Crops (Horticultural Science Series Vol. III). New India Publishers, New Delhi.
3. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 2004. Scientific Fruit culture, Suri Associates, Coimbatore.

## **PAPER 2: ORNAMENTAL AND LANDSCAPE GARDENING**

### **CONTENT:**

- Unit 1:** History of Gardening and Principles of Landscaping-Ornamental and landscape horticulture, definitions, scope, importance of gardening, history of gardening, types of gardens, Hindu, Buddhist, Persian, Mughal, Japanese, English, French and Italian garden – formal, informal and beauty elements, basic principles of gardening.
- Unit 2:** Soft Scape Elements-Soft scape elements (living components), trees, shrubs, shrubbery, creepers, climbers, herbs, annuals, hedges, edges, topiary, trophy, flowers and foliage beds, carpet beds, palmate, ferns, rosarium, rockery, sunken garden, hanging baskets, cacti and succulents plants, basic function and utility, their culture, training and pruning, lawn, lawn grasses, methods of establishment, Maintenance of lawn, house plants, Indoor gardening, psychological and social aspects of ornamental plants.
- Unit 3:** Hard Scape Elements-Hardscape elements (non – living component), garden adornments, fences, gates, arches, pergolas, walks, paths, roads, paving, borders and edges, water features, pools and ponds, cascades, falls, bridges, fountains, lights planter boxes, trellis, gazebo, designing, basic function and utility, fabrication, establishment and maintenance, non-living components for special situations.
- Unit 4:** Landscape Designing and Executions-Basic concepts of designing gardens, site analysis, client preference, landscape drawing, types of drawing, plan view, elevation and perspective diagrams, manual drawing, computerized drawing, plan to scale/not to scale, symbols/legends, designing for residences, educational institutes, industrial garden, public parks, amusement and theme parks, traffic islands.
- Unit 5:** Conceptual Gardening and Horticultural Crafts-Bio aesthetic planning, water garden, floating plants, oxygenating plants, bog garden, vertical garden, rock garden, roof garden, modern day special types of gardens, yoga and meditation garden, instant garden, xeriscaping, bonsai, plants for bonsai, methods of bonsai culture, terrarium, flower arrangement, types of flowers, concepts, styles, purpose, methods, cut foliage, its uses in flower arrangement, importance in flower arrangement, dry flower making, vegetable and fruit carving, plant jewels.

### **PRACTICAL**

1. Identification of ornamental plants.
2. Identification of different components – their form, size, shape, texture flowering and other beauty components.
3. Evaluation of different garden sites in campus.
4. Description of trees, shrubs, herbs and annuals.
5. Description of climbers, creepers, flowers and foliage beds.
6. Art of topiary, trophy and carpet beds.

7. Identification of lawn grasses.
8. Methods of establishment of lawn grasses.
9. Maintenance of lawn grasses.
10. Description of non – living components.
11. Study on beauty components.
12. Principles and fundamentals of designing garden.
13. Practices on manual and computer aided landscape designing.
14. Preparation of landscape plan for home, Institute and Industry gardens.
15. Preparation of landscape plan for public parks.
16. Practices on Horticultural crafts – bonsai, terrarium and flower arrangements, Vegetable and fruit carving.

### **Suggested Readings**

1. Bhattacharjee, S.K. 2004. Landscape Gardening and Design with plants. Aavishkar Publishers and Distributers, Jaipur.
2. Bose T.K., B. Chowdhury and S.P. Sharma 2001. Tropical Garden Plants in Colour. Horticulture and Allied Publishers, Kolkata.
3. Chadha, K.L. and B. Choudhury 2014. Ornamental Horticulture in India. ICAR. Krishi Bhavan, New Delhi.
4. Karuppaiah P.and K. Manivannan. 2016. Ornamental Horticulture.Agrobios (India) Jodhpur.
5. Nambisan, K.M.P. 1992. Design Elements of Landscape Gardening, Oxford and IBH Publications Co. (P) Ltd., Kolkata.
6. Randhawa, G.S. and A. Mukhopadyay. 1998. Floriculture in India. Allied publishers Limited, New Delhi

## **PAPER 3: PRODUCTION TECHNOLOGIES OF VEGETABLE CROPS**

### **CONTENT:**

**Unit 1:** Scope and Importance of Olericulture-area and production, global and national scenario, institutions involved in vegetable crops research, export potential, constraints in vegetable production , classification of vegetable crops, types of vegetable nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden, vegetable forcing, contract farming, rice fallow cultivation, river bed cultivation, rain fed cultivation, GAP in vegetable production, export standards of vegetables.

**Unit 2:** Solanaceous and Malvaceous Vegetable Crops-Origin and distribution, area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, nursery practices, containerized transplant production and transplanting, preparation of field, spacing, cropping system, planting methods, manuring and nutrient management, water and weed management, mulching, nipping, fertigation, nutrient deficiencies, physiological disorders, growth regulators, sex expression, maturity indices, harvest, yield, seed production and storage of the following crops: Tomato, brinjal, chilli, capsicum and bhendi.

**Unit 3:** Cucurbitaceous Vegetable Crops-Ash gourd, pumpkin, bottle gourd bitter gourd, snake gourd, ribbed gourd, watermelon, musk melon, coccinia, cucumber and gherkin.

**Unit 4:** Legumes, Bulbs and Tuber Crops-Peas and Beans, amaranthus, onion, potato, tapioca and sweet potato.

**Unit 5:** Temperate Vegetables-Cauliflower, cabbage, knol, khol, turnip, beetroot and carrot.

### **PRACTICAL**

1. Preparation of nursery bed, containerized transplant production and sowing of vegetable seeds.
2. Preparation of field – raising of a transplanted vegetable crop.
3. Preparation of field, sowing of cucurbitaceous, perennial and leafy vegetable and tuber crops.
4. Identification and description of varieties and hybrids of solanaceous and leguminous vegetables.
5. Identification and description of varieties and hybrids of bhendi, cucurbits, root and tuber crops.
6. Planning and lay out of kitchen /nutrition garden.
7. Study of rain fed and padugai land cultivation practices in vegetable crops.
8. Practices in manuring and fertilizer application in vegetable crops.
9. Practices in irrigation practices of vegetable crops.



10. Preparation of plant growth regulator spray solution – their usage in tropical vegetable crops.
11. Identification of nutrient deficiencies, physiological disorders and corrective measures in vegetable crops.
12. Maturity indices, harvesting and post – harvest handling of vegetable crops.
13. Practices in seed production techniques in vegetable crops.
14. Commercial vegetable production in protected structures.
15. Project preparation for commercial cultivation of tropical vegetable crops.
16. Visit to commercial vegetable production units.

### **Suggested Readings**

1. Bishwajit Choudhury. 2003. Vegetables. International Book Trust, New Delhi.
2. Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. Vegetable Crops Vol. I, II & III. NayaProkash, Kolkata.
3. Gopalakrishnan, T.R., 2007. Vegetable Crops. New India Publishing Agency, New Delhi.
4. Nem Pal Singh. A.K. Bhardwaj, K.M. Singh and Abnish Kumar. 2004. Modern Technology on Vegetable production. International Book Distributing Co., Lucknow.
5. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. Modern Technology in Vegetable production. New India Publishing Agency, New Delhi.
6. Uma Shankar Singh, 2008. Indian Vegetables. Anmol publications Pvt., Ltd., New Delhi.
7. Veeraraghavathatham. D., M Jawaharlal and Seemanthini Ramdas. 1991. A guide on vegetable culture. A. E. Publications, Coimbatore.
8. Vishnu Swarup, 2006. Vegetable science and technology in India. Kalyani publishers, New Delhi.

## **PAPER 4: BASICS IN PLANT PATHOLOGY**

### **PRACTICAL**

1. Disease triangle.
2. Classification of plant diseases.
3. Field diagnosis and identification of crop diseases.
4. Disease surveillance, assessment and forecasting – Diagnosis of plant diseases
5. Protection of crops from air – borne, seed – borne, soil – borne and vector – borne plant diseases.
6. Physical methods – soil solarization, Hot water treatment, Incineration, Chemical control of plant diseases.
7. Fungicides – Different group of fungicides and antibiotics in plant disease management.
8. Biological control of plant diseases.
9. Plant products in disease management.
10. Antiviral principles.
11. Method of application.
12. Identification and monitoring of fungal, bacterial, phytoplasma and viral disease.
13. Mass production of Trichoderma.
14. Mass Production of Pseudomonas.
15. Identification of fungal and bacterial, Phytoplasmal crop diseases.
16. Identification of different groups of fungicides, bactericides, their preparation and use.

### **Suggested Readings**

1. Agrios, G.N. 2005. Plant Pathology. 5th Edition Academic Press, New York.
2. Chattopadhyay, S.G. 1998. Principles and procedure of plant protection – Oxford and IBH publication, New Delhi.
3. Oxford and IBH Publishing Co. Ltd., New Delhi.
4. Prakasam, V., Raguchander, T and Prabakar, K. 1998. Plant Disease Management, A.E. Publication, Coimbatore.
5. Vidyasekaran, P. 1993. Principles of Plant Pathology, CBS Publishers and Distributors, New Delhi.

## **PAPER 5: FARM MACHINERY FOR HORTICULTURAL CROPS**

### **CONTENT:**

**Unit 1:** Farm Power- Power sources for horticulture, IC engines, working principles, two stroke and four stroke engines, different systems of an IC engine.

**Unit 2:** Orchard tractors – types, Selection of tractors and cost of tractor power, Tractor and implement selection for different horticultural operations.

**Unit 3:** Plant protection, harvesting and orchard management machinery Plant protection equipment for orchards.

**Unit 4:** Harvesting tools and equipment. Harvesting machinery for vegetable and fruit crops, tuber crops, tree and plantation crops.

**Unit 5:** Lawn management machinery – lawn mowers and machinery.

### **PRACTICAL**

1. Study of different components of IC engine, four stroke petrol engine, two stroke petrol engine.
2. Identification of components of MB plough, disc plough, seed planters, their working mechanisms.
3. Operation of tractor and implements, operation and maintenance power tiller
4. Study of different inter, cultivation equipments, pruners, Sprayers and dusters – their operation, repairs and adjustment
5. Harvesting tools and harvesters for horticultural crops
6. Field capacity and cost analysis

### **Suggested Readings**

1. Jagadishwar Sahay, 1992. Elements of Agricultural Engineering. Agro book agency, Patna – 20.
2. Michael and T.P. Ojha, 1996. Principles of Agricultural Engineering. Jain brothers, New Delhi.
3. Nakra C.P 1970. Farm Machinery and equipment: Dhanpat Rai & Son
4. Bindra, O.S. and Harcharan Singh, 1971. Pesticide Application Equipment. Oxford and IBH pub Co., New Delhi.
5. Srivastava, A.C., 1990. Elements of Farm Machinery. Oxford IBH pub Co., New Delhi.

