

# M.Sc. (Horticulture)

## Ist SEMESTER

Subject Code	Name of Subject	Teaching Periods		Credit Points
		T	P	
01MSC19101	TROPICAL AND DRY LAND FRUIT PRODUCTION	2	1	3(2+1)
01MSC19102	SUB- TROPICAL AND TEMPERATE FRUIT PRODUCTION	2	1	3(2+1)
01MSC19103	PROPAGATION AND NURSERY MANAGEMENT FOR FRUIT CROPS	2	1	3(2+1)
01MSC19104	PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS	2	1	3(2+1)
01MSC19301	Discipline & Co. curricular activity	0	1	1(0+1)
Total		8	5	13

## **01MSC19101 TROPICAL AND DRY LAND FRUIT PRODUCTION 3(2+1)**

### **Theory**

Commercial varieties of regional, national and international importance, eco-physiological, 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, physiology disordercauses 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 tropic

### **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.

### **Suggested Readings**

- Bose TK, Mitra SK & Rathore DS. (Eds.). 1988. *Temperate Fruits -Horticulture*. Allied Publ.
- Bose TK, Mitra SK & Sanyal D. 2001. (Eds.). *Fruits -Tropical and Subtropical*. Naya Udyog.
- Chadha KL & Pareek OP. 1996 (Eds.). *Advances in Horticulture*. Vols. IIIIV Mallotra Publ. House.
- Nakasone HY & Paul RE. 1998. *Tropical Fruits*. CABI.
- Peter KV. 2008 (Ed.). *Basis of Horticulture*. New India Publ. Agency.
- Pradeep Kumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008. *Management of Horticultural Crops*. Parts I, II. New India Publ. Agency.
- Radha T & Mathew L. 2007. *Fruit Crops*. New India Publ. Agency.
- Singh HP, Negi JP & Samuel JC. (Eds.) 2002. *Approaches for Sustainable Development of Horticulture*. National Horticulture Board.
- Singh HP, Singh G, Samuel JC & Pathak RK. (Eds.). 2003. *Precision Farming in Horticulture*. NCPAH, DAC/PFDC, CISH, Lucknow.

## **01MSC19102 SUB- TROPICAL AND TEMPERATE FRUIT PRODUCTION 3(2+1)**

### **Theory**

Commercial varieties of regional, national and international importance, eco-physiological requirements, recent trends in propagation, rootstock in fluency, planting systems, copping systems, root zone and canopy management, nutrient management, water management, fertigation, bioregulation, abiotic factors limiting fruit production, physiology of flowering, fruit set 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, hazelnut

**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 propical, subtropical, humid tropical and temperate orchards, Project preparation for establishing commercial orchards.

### **Suggested Readings**

- Bose TK, Mitra SK & Sanyol D. (Ed.) 2002. *Fruits of India - Tropical and Sub-tropical*. 3rd Ed. Vols. I, II. Naya Udyog.
- Chadha KL & Shikhamany SD. 1999. *The Grape : Improvement, Production and Post-Harvest Management*. Malhotra Publ. House.
- Janick J & Moore JN. 1996. *Fruit Breeding*. Vols. I-III. John Wiley & Sons.
- Nijjar GS, 1977 (Eds.). *Fruit Breeding in India*. Oxford & IBH.
- Radha T & Mathew L. 2007. *Fruit Crops*. New India Publ. Agency.
- Singh S, Shivankar VJ, Srivastava AK & Singh IP. (Eds.). 2004. *Advances in Citriculture*.

## **01MSC19103 PROPAGATION AND NURSERY MANAGEMENT FOR FRUIT**

### **CROPS 3(2+1)**

#### **Theory**

#### **UNIT- I**

Introduction, life cycle 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 cutting 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, micro propagation, explants 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.

### **Suggested Readings**

- Harmann HT & Kester DE. 1989. *Plant Propagation - Principles and Practices*. Prentice Hall of India.
- Bose TK, Mitra SK & Sadhu MK. 1991. *Propagation of Tropical and Subtropical Horticultural Crops*. Naya Prokash.
- Peter KV. (Ed.) 2008. *Basis of Horticulture*. New India Publ. Agency.
- Singh SP. 1989. *Mist Propagation*. Metropolitan Book Co.
- Rajan S & Baby LM. 2007. *Propagation of Horticultural Crops*. New India Publ. Agency.

## **01MSC19104 PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS 3(2+1)**

### **Theory**

Introduction, and taxonomy, climatic and soil requirements, commercial varieties/ hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of :

### **UNIT - I**

Potato

### **UNIT - II**

Cole crops : cabbage, cauliflower, knol khol, sprouting broccoli and Brussels sprout

### **UNIT - III**

Root crops : Carrot, Radish, Turnip and Beetroot

### **UNIT - IV**

Bulb Crops : Onion and garlic

### **UNIT - V**

Peas and broad bean, green leafy cool season vegetables

### **Practical**

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economics; Experiments to demonstrate the role of mineral elements, plant growth substances and herbicides; study of physiological disorders; preparation of cropping scheme for commercial farms; visit to commercial greenhouse/polyhouse.

### **Suggested Readings**

- Bose TK & Som MG. (1986) *Vegetable Crops in India*. Naya Prokash, Calcutta

- Bose TK, Som G & Kabir J. (2002). *Vegetable Crops*. Naya Prokash, Kolkata.
- Bose TK, Som MG & Kabir J. (1993). *Vegetable Crops*. Naya Prokash, Kolkata.
- Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. (2003). *Vegetable Crops*. Vols. I-III, Naya Udyog
- Chadha KL & Kalloo G. (1934-94), *Advances in Horticulture* Vols. V-X, Malhotra Publ. House, New Delhi
- Chadha KL. (2002). *Hand Book of Horticulture*. ICAR, New Delhi.
- Chauhan DVS. (1986). *Vegetable Production in India*. Ram Prasad & Sons.
- Decoteau DR. (2000). *Vegetable Crops*. Prentice Hall.
- Edmond JB, Musser AM & Andrews FS. (1951). *Fundamentals of Horticulture*. Blakiston Co.
- Fageria MS, Choudhary BR & Dhaka Rs. (2000). *Vegetable Crops :Production Technology*. Vol. II. Kalyani Publisher, New Delhi.
- Gopalakrishanan TR. (2007). *Vegetable Crops*. New India Publ. Agency, New Delhi.
- Hazra P & Som MG. (1999). *Technology for Vegetable Production and Improvement*. Naya Prokash, Kolkata.
- Rana MK. (2008). *Olericulture in India*. Kalyani Publ., New Delhi.
- Rama MK. (2008). *Scientific Cultivation of Vegetables*. Kalyani Publ., New Delhi.
- Rubatzky VE & Yamaguchi M. (1997). *World Vegetables : Principles, Production and Nutritive Values*. Chapman & Hall.
- Saini GS (2001). *A Text Book of Oleri and Flori Culture*. Aman Publ. House.
- Salunkhe DK & Kadam SS. (1998). *Hand Book of Vegetable Science and Technology : Production, Composition, Storage and Processing*. Marcel Dekker.
- Shanmugavelu KG (1989). *Production Technology of Vegetable Crops*. Oxford & IBH.
- Singh DK. (2007). *Modern Vegetable Varieties and Production Technology*. International Book Distributing Co. Lucknow
- Singh SP. (1989). *Production Technology of Vegetable Crops*. Agril. Comm. Res. Centre. Karnal
- Thamburaj S & Singh N. (2004). *Vegetables. Tuber Crops Crops and Spices*. ICAR. New Delhi.
- Thompson HC & Kelly WC. (1978). *Vegetable Crops*. Tata McGraw-Hill.

## II Semester

Subject Code	Name of Subject	Teaching Periods		Credit Points
		T	P	
02MSC19101	PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLE CROPS	2	1	3(2+1)
02MSC19102	SEED PRODUCTION TECHNOLOGY OF VEGETABLE CROPS	2	1	3(2+1)
02MSC19103	COMMERCIAL FLORICULTURE	2	1	3(2+1)
02MSC19104	LANDSCAPING AND ORNAMENTAL GARDENING	2	1	3(2+1)
02MSC19301	<b>Discipline &amp; Co. curricular activity</b>	0	1	1(0+1)
Total		8	5	13

**02MSC19101      PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLE  
CROPS 3(2+1)**

**Theory**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures, economics of crop production and seed production of :

**UNIT - I**

Tomato, eggplant, hot and sweet peppers

**UNIT - II**

Okra, beans (French bean, Indian bean and cluster bean), cowpea

**UNIT - III**

Cucurbitaceous crops

**UNIT - IV**

Tapioca, sweet potato and colosia

**UNIT - V**

Green leafy warm season vegetables

**Practical**

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics; study of physiological disorders and deficiency of mineral elements, preparation of cropping schemes for commercial farms; experiments to demonstrate the role of mineral elements, physiological disorders; plant growth substances and herbicides; seed extraction techniques; identification of important pests and diseases and their control; maturity standards; economics of warm season vegetable crops.

**Suggested Readings**

- Bose TK & Som MG. (1986) *Vegetable Crops in India*. Naya Prokash, Calcutta
- Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. (2003). *Vegetable Crops*. Vols. I- III. Naya udyog.
- Bose TK, Som MG & Kabir J. (2002). *Vegetable Crops*. Naya Prokash, Kolkata.
- Brown HD & Hutchison CS. *Vegetable Science*. JB Lippincott Co.
- Chadha KL & Kalloo G. (1934-94), *Advances in Horticulture* Vols. V-X, Malhotra Publ. House, New Delhi
- Chadha KL. (2002). *Hand Book of Horticulture*. ICAR, New Delhi.
- Chauhan DVS. (1986). *Vegetable Production in India*. Ram Prasad & Sons.
- Decoteau DR. (2000). *Vegetable Crops*. Prentice Hall. New Delhi.
- Edmond JB, Musser AM & Andrews FS. (1964). *Fundamentals of Horticulture*. Blakiston Co.
- Fageria MS, Choudhary BR & Dhaka Rs. (2000). *Vegetable Crops: Production Technology*. Vol. II. Kalyani Publisher, New Delhi.
- Gopalakrishanan TR. (2007). *Vegetable Crops*. New India Publ. Agency, New Delhi.
- Hazra P & Som MG. (1999). *Technology for Vegetable Production and Improvement*. Naya Prokash, Kolkata.
- Kalloo G & Singh K. (2000) *Emerging Scenario in Vegetable Research and*

Development. Research Periodicals & Book Publishing House, Houston, Texas, USA.

- Nayer NM & More TA (1998). Cucurbits. Oxford & IBH Publ. Co., New Delhi.
- Rana MK. (2008). Olericulture in India. Kalyani Publ., New Delhi.
- Rama MK. (2008). Scientific Cultivation of Vegetables. Kalyani Publ., New Delhi.
- Rubatzky VE & Yamaguchi M. (1997). World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall.
- Saini GS (2001). A Text Book of Oleri and Flori Culture. Aman Publ. House.
- Salunkhe DK & Kadam SS. (1998). Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker Inc., New York.
- Shanmugavelu KG (1989). Production Technology of Vegetable Crops. Oxford & IBH Publishing Co., New Delhi.
- Shanmugavelu KG. (1989). Production Technology of Vegetable Crops. Oxford & IBH Distributing Co., Lucknow
- Singh DK. (2007). Modern Vegetable Varieties and Production Technology. International Book Distributing Co. Lucknow
- Singh NP, Bhardwaj AK, Kumar A & Singh KM. (2004). Moder Technology on Vegetable Production. International Book Distributing Co. Lucknow
- Singh SP. (1989). Production Technology of Vegetable Crops. Agril. Comm. Res. Centre. Karnal
- Thamburaj S & Singh N. (2004). Vegetables. Tuber Crops Crops and Spices. ICAR. New Delhi.

## **02MSC19102 SEED PRODUCTION TECHNOLOGY OF VEGETABLE CROPS 3(2+1)**

### **UNIT - I**

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India.

### **UNIT - II**

Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behavior, seed Development and maturation; methods of hybrid seed production.

### **UNIT - III**

Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control.

### **UNIT - IV**

Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packing (containers/packets), storage and cryopreservation of seeds, synthetic seed technology.

### **UNIT - V**

Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra, vegetatively propagated vegetables.

### **Practical**

Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, physical purity) and seed health testing; testing, releasing and notification procedures of varieties; floral biology; rouging of off-type; methods of hybrid seed production in important vegetable and spice crops; seed extraction techniques; handling of seed processing and seed testing equipments; seed sampling; testing of vegetable seeds for seed purity, germination, vigour and health; visit to seed processing units, seed testing laboratory and seed production farms.



## Suggested Reading

- Agrawal PK & Dadlani M. (1992). Techniques in Seed Science and Technology. South Asian Publ.
- Agarwal RL. (1997). Seed Technology. Oxford & IBH.
- Benedell PE. (1998). Seed Science and Technology : Indian Forestry Species. Allied Publ.
- Fageria MS, Arya PS & Choudhary AK. (2000). Vegetable Crops : Breeding and Seed Production. Vol I. Kalyani Publishers, New Delhi.

## **02MSC19103      COMMERCIAL FLORICULTURE    3(2+1)**

### **Theroy**

Scope and importance of floriculture in India. Production techniques of ornamental plants for domestic and export markets. Growing of flowers under protected environments such as glass house, plastic house etc. Post-harvest technology of cut flowers in respect of commercial flower crops, dehydration techniques for drying of flowers, Production techniques for bulbous plants.

### **(A) PRODUCTION TECHNOLOGY OF CUT FLOWERS**

#### **UNIT - I**

Scope of cut flower in global trade, Global Scenario of cut flower production, Varietal wealth and diversity, area under cut flowers and production problems in India – Patents right, nursery management, media for nursery, special nursery practices.

#### **UNIT - II**

Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO<sub>2</sub> on growth and flowering.

#### **UNIT - III**

Flower Production - water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

#### **UNIT - IV**

Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation.

#### **UNIT - V**

Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, Methods of delaying flower opening, Pre-cooling, pulsing, packing, Storage & transportation, marketing, export potential, institutional support, Agri Export Zones.

**Crops :** Cut rose, cut chrysanthemum, carnation, gerbera, gladioli, tuberose, orchids, anthurium, aster, liliiums, bird of paradise, hiliconia, alstromeria, alpinia, ornamental ginger, bromeliads, dahila, gypsohilla, limonium, statice, stock, cut foliage and fillers.

### **Practical**

Botanical description of varieties, propagation techniques, mist chamber operation, training and pruning techniques, practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking, harvesting techniques, postharvest handling, cold chain, project preparation for regionally important cut flowers, visit to commercial cut flower units and case study.

### **Suggested readings**

- Arora JS. 2006 Introductory Ornamental Horticulture. Kalyani.
- Bhattacharjee SK. 2006. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ.
- Bose TK & Yadav LP. 1989. Commercial Flowers. Naya Prokash.
- Bose TK, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping. Naya Prokash.
- Chandha KL & Chaudhary B. 1992. Ornamental Horticulture in India CAR.
- Chandha KL 1995. Advances in Horticulture. Vol. XII Malhotra Publ. House.
- Lauria A & Ries VH. 2001. Floriculture- Fundamentals and Practices. Agrobios.
- Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios.
- Randhawa GS & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
- Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. Hightech floriculture. Indian Society of Ornamental Horticulture, New Delhi.

## **(B) PRODUCTION TECHNOLOGY FOR LOOSE FLOWERS**

### **Unit - I**

Scope of loose flower trade, Significance in the domestic market/export, Varietal wealth and diversity, propagation, sexual and asexual propagation methods, propagation in mist chambers, nursery management, pro-tray nursery under shadenets, transplanting techniques.

### **Unit - II**

Soil and climate requirements, field preparation, systems of planting, precision farming techniques.

### **Unit - III**

Water and nutrient management, weed management, rationing, training and pruning, pinching and disbudding, special horticulture practices, use of growth regulators, physiological disorders and remedies, IPM and IDM.

### **Unit - IV**

Flower forcing and year round flowering, production for special occasions through physiological interventions, chemical regulation.

### **Unit - V**

Harvest indices, harvesting techniques, post-harvest handling and grading, pre-cooling, packing and storage, value addition, concrete and essential oil extraction, transportation and marketing, export potential, institutional support, Agri Export Zones.

**Crops :** Jasmine, scented rose, chrysanthemum, marigold, tuberose, crossandra, nerium, hibiscus, barleria, celosia, gomphrena, non-traditional flower (Nyctanthes, Tabemacmontana, ixora, lotus. Lilies, Tecoma, Champaka and Pandarus).

### **Practical**

Botanical description of species and varieties, propagation techniques, mist chamber operation, training and pruning techniques, practice in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking, harvesting techniques, post-harvest handling, storage and cold chain project preparation for regionally important commercial loose flowers, visits to fields, essential oil extraction units and markets.

### **Suggested Readings**

- Arora JS. 2006 Introductory Ornamental Horticulture. Kalyani Publishers.
- Bhattacharjee SK. 2006. Advances in Ornamental Horticulture Vols. I-VI Pointer Publ.
- Bose TK & Yadav LP. 1989. Commercial Flower. Naya Prokash.
- Bose TK & Maiti RG. Dhua RS & Das P. 1999. Floriculture and Landscaping. Naya Prokash.

- Chadha KL & Chaudary B. 1992. Ornamental Horticultural in India. CAR.
- Chadha KL 1995 Advances in Horticulture - Vol XII. Malhotra Publ. House
- Laurie A & Ries VH. 2001. Floriculture - Fundamentals and Practices. Agrobios
- Prasad S & Kumar U. 2003 Commercial Floriculture. Agrobios
- Randhawa GS & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
- Shella VL. 2007. Flowers in Trade. New India Publ. Agency
- Valsalakumari PK, Rajeevan PK, Sudhadevi PK & Geetha CK. 2008. Flowering

## **02MSC19104      LANDSCAPING AND ORNAMENTAL GARDENING      3(2+1)**

### **Objective**

Familiarization with principles and practices of landscaping and ornamental gardening.

### **Theory**

#### **Unit - I**

Landscape designs, types of gardens, English, Mughal, Japanese, Persian, Spanish, Italian, Vanarns, Buddha garden; Styles of garden, formal, informal and free style gardens.

#### **Unit - II**

Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, dam sites, IT parks, corporates.

#### **Unit - III**

Garden plant components, arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.

#### **Unit - IV**

Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, sunken garden, rock garden, clock garden, colour wheels, temple garden, sacred groves.

#### **Unit - V**

Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

### **Practical**

Selection of ornamental plants, practices in preparing designs for home gardens, industrial gardens, industrial gardens, corporates, avenue planting, practices in planning and planting of special types of gardens, burlapping, lawn making, planting herbaceous and shrubbery borders, project preparation on landscaping for different situations, visit to parks and botanical gardens, case study on commercial landscape gardens.

### **Suggested Readings**

- Bose TK, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping. Naya Prokash.
- Lauria A & Victor HR. 2001. Floriculture - Fundamentals and Practices Agrobios.
- Nambisan KMP. 1992. Design Elements of Landscape Gardening Oxford & IBH.
- Randhawa GS & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
- Sabina GT & Peter KV. 2008. Ornamental Plants for Gardens. New India Publ. Agency

### III Semester

Subject Code	Name of Subject	Teaching Periods		Credit Points
		T	P	
03MSC19101	PROTECTED FLORICULTURE	2	1	3(2+1)
03MSC19102	PRODUCTION OF PLANTATION CROPS	2	1	3(2+1)
03MSC19103	PRODUCTION TECHNOLOGY OF SPICE CROP	2	1	3(2+1)
03MSC19104	PRODUCTION TECHNOLOGY FOR MEDICINAL AND AROMATIC CROPS	2	1	3(2+1)
03MSC19301	Discipline & Co. curricular activity	0	1	1(0+1)
Total		8	5	13

**03MSC19101 PROTECTED FLORICULTURE****3(2+1)****Theory****UNIT - I**

Prospects of protected floriculture in India; Types of protected structures - Greenhouses, polyhouses, shade houses, rain shelters etc., Designing and erection of protected structures; Low cost/ Medium cost/ High cost structure - economics of cultivation; Location specific designs; Structure components; Suitable flower crops for protected cultivation.

**UNIT - II**

Environment control - management and manipulation of temperature, light, humidity, air and CO<sub>2</sub>; Heating and cooling systems, ventilation, naturally ventilated greenhouses, fan and pad cooled greenhouses, light regulation.

**UNIT - III**

Containers and substrates, soil decontamination, layout of drip and fertigation system, water and nutrient management, weed management, physiological disorders, IPM and IDM.

**UNIT - IV**

Crop regulation by chemical methods and special horticultural practices (pinching, disbudding, deshooting, deblossoming, etc.); Stacking and netting, Photoperiod regulation.

**UNIT - V**

Harvest indices, harvesting techniques, post-harvest handling techniques, Precooling, sorting, grading, packing, storage, quality standards.

**Practical**

Study of various protected structures, practices in design, layout and erection of different types of structures, practices in preparatory operations, soil decontamination techniques, practices in environmental control systems, practices in drip and fertigation techniques, special horticultural practices, determination of harvest indices and harvesting methods, post-harvest handling, packing methods, project preparation, visit to commercial greenhouses.

**Suggested Readings**

- Bhattacharjee SK. 2006. Advances in Ornamental Horticulture Vols. I-VI Pointer Publ.
- Bose TK & Yadav LP. 1989. Commercial Flower. Naya Prokash.
- Bose TK & Maiti RG. Dhua RS & Das P. 1999. Floriculture and Landscaping. Naya Prokash.
- Chadha KL 1995 Advances in Horticulture - Vol XII. Malhotra Publ. House
- Laurie A & Victor HR 2001. Floriculture - Fundamentals and Practices. Agrobios
- Nelson PV. 1978 Green House Operation and Management. Reston Publ. Co.
- Prasad S & Kumar U. 2003 Commercial Floriculture. Agrobios
- Randhawa GS & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
- Reddy S, Janakiran B. Balaji T, Kulkarni S & Misra RL. 2007. Hightech Floriculture.

Indian of ornamental Horticulture, New Delhi.

**(B) VALUE ADDITION****Theory****Unit - I**

Prospects of value addition, National and global scenario, production and exports, Women empowerment through value added products making, supply chain management.

**Unit - II**

Types of value added products, value addition in loose flowers, garlands, veni, floats, floral decorations, value addition in cut flowers, flower arrangement, styles, Ikebana, morebana, free style, bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands, etc; Selection of containers and accessories for floral product and decorations.

### **Unit - III**

Dry flowers - Identification and selection of flowers and plant parts; Raw material procurement, preservation and storage; Techniques in dry flower making - Drying, bleaching, drying, embedding, pressing; Accessories; Designing and arrangement - dry flower baskets, bouquets, pot-pourri, wall hangings, button holes, greeting cards, wreaths; packing and storage.

### **Unit - IV**

Concrete and essential oils : Selection or species and varieties (including non-conventional species), extraction methods, Packing and storage. Selection of species and varieties, Types of pigments, carotenoids, anthocyanin, Chlorophyll, betalains; Significance of natural pigments, Extraction methods; Applications.

### **Practical**

Practices in preparation of bouquets, button-holes, flower baskets, corsages, loral wreaths, garlands with fresh flowers; Techniques in flower management; Techniques in floral decoration; Identification of plants for dry flower making; Practices in dry flower making; Preparation of dry flower baskets, bouquets, pot-pourri, wall hangings, button holes, greeting cards, wreaths etc.; Visit to dry flower units concrete and essential oil xtraction units.

### **Suggested Readings**

- Bhattacharjee SK 2006. Advances in Ornamental Horticulture Vols. I-VI ointer Publ.
- Chadha KL 1995. Advances in Horticulture. Vol XII. Malhotra Publ ouse.
- Lauria A &Victor HR. 2001. Flouriculture - Fundamentals and Practices grobios.
- Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios.
- Reddy S, Janakiram B, Blaji T, Kulkarni S & Mishra RL. 2007. Hightest loriculture.

## **03MSC19102      PRODUCTION OF PLANTATION CROPS    3(2+1)**

### **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, shate 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 areacanut

**UNIT V :**Wattle and betal 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.

### **Suggested Readings**

- Anonymous, 1985 Rubber and its Cultivation. The Rubber Board of India.
- Chopra VL & Peter KV. 2005 Handbook of Industrial Crops. Panima.
- Harler CR 1963. The Culture and Marketing of Tea. Oxford Univ. Press.
- Kurian A & Peter KV. 2007. Commercial Crops Technology. New India Pub/. Agency.
- Nair MK, Bhaskara Rao EVV, Nambiar KKN & Nambiar MC 1979 Cashew. CPCRI, Kasaragod.
- Peter KV.2002. Plantation Crops. National Book Trust.
- Pradeep Kumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008
- Management of Horticulture Crops Part I, II, New India Publ. Agency.
- Rai PS & Vidyachandram B. 1981, Review of work done on cashew UAS, Research Series No. 6 Bangalore.
- Ranganathan V, 1979 Hand Book of Tea Cultivation , UPASI, Tea Res, Stn, Cinchona
- Srivastava HC, Vatsaya B & Menon KKG, 1986 Plantation Crops.
- Opportunities and Constraints, Oxford & IBH.
- Thampan PK 1981. Hand Book of Coconut Palm, Oxford & IBH

## **03MSC19103 PRODUCTION TECHNOLOGY OF SPICE CROP 3(2+1)**

### **Theory**

Introduction, importance of spice crops-historical accent, present status - national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties/ hybrids, site selection, layout, sowing/ planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of :

#### **UNIT I :**

Black pepper, cardamom

#### **UNIT II :**

Clove, Cinnamon and nutmeg, Allspice

#### **UNIT III :**

Turmeric, ginger and garlic

#### **UNIT IV :**

Coriander, fenugreek, cumin, fennel, ajowain, dill, celery

#### **UNIT V :**

Tamarind, garcinia and vanilla

### **Practical**

Identification of seeds and plants, botanical description of plant, preparation of herbarium, propagation, nursery raising, field layout and method of planting, cultural practices, harvesting, drying, storage, packaging and processing, value addition, short term experiments on spice crops.

### **Suggested Readings**

- Agarwal S, Sastry EVD & Sharma RK.2001 Seed Spices: Production, Quality, Export





Production technology for Medicinal solanum, Isabgol, Poppy, Safed musli, Stevia rebaudiana, Mucuna pruriens, Ocimum sp.

#### **UNIT - IV**

Post harvest handling - Drying, Processing, Grading, Packing and Storage, processing and value addition, GMP and Quality standards in herbal products.

#### **UNIT - V**

Influence of biotic and abiotic factors on the production of secondary metabolites, Regulations for herbal raw materials, Phytochemical extraction techniques.

#### **UNIT - VI**

Aromatic industry, WTO scenario, Export status, Indian perfumery industry, History, Advancements in perfume industry.

#### **UNIT - VII**

Production technology for palmarosa, lemongrass, citronella, vetiver, geranium, artemisia, mentha, ocimum, eucalyptus, rosemary, thyme, patchouli, lavender, marjoram, oreganum.

#### **UNIT - VIII**

Post-harvest handling, Distillation methods, advanced methods, Solvent extraction process, steam distillation, Perfumes from non-traditional plants, Quality analysis, Value addition, Aroma chemicals, quality standards and regulations.

#### **UNIT - IX**

Institutional support and international promotion of essential oil and perfumery products.

#### **Practical**

Botanical description, Propagation techniques, Maturity standards, Digital documentation, Extraction of secondary metabolites, Project preparation for commercially important medicinal crops, Visit to medicinal crop field, Visit to herbal extraction units. Extraction of Essential oils, Project preparation for commercially important Aromatic crops, Visit to distillation and value addition units - Visit to CIMAP.

#### **Suggested Readings**

- Atal CK & Kanpur BM 1982. Cultivation and Utilization of Aromatic Plants. RRL, CSIR, Jammu.
- Atal CK & Kanpur BM. 1982. Cultivation and Utilization of Medicinal Plants RRL, CSIR, Jammu.
- Farooqu AA, Khan MM & Vasundhara M. 2001. Production Technology of Medicinal and Aromatic Crops. Natural Remedies Pvt. Ltd.
- Hota D. 2007. Bio Active Medicinal Plants. Gene Tech Books.
- Jain SK. 2000. Medicinal Plants. National Book Trust.
- Khan IA & Khanum A. Role of Bio Technology in Medicinal and Aromatic Plants. Vol. IX. Vkaaz Publ.
- Kurian A & Asha Sankar M. 2007. Medicinal Plants. Horticulture Science Series, New India Publ. Agency.
- Panda H. 2002. Medicinal Plants Cultivation and their Uses. Asia Pacific Business Press.
- Prajapati SS, Paero H, Sharma AK & Kumar T. 2006. A Hand book of Medicinal Plants. Agro Bioss.
- Ramawat KG & Merillon JM. 2003 Bio Technology-Secondary Metabolites. Oxford & IBH.
- Skaria P Baby, Samuel Mathew, Gracy Mathew, Ancy Joseph, Ragina Joseph. 2007. Aromatic Plants. New India Publ. Agency

### IV semester

Subject Code	Name of Subject	Teaching Periods		Credit Points
		T	P	
04MSC19101	SEMINAR	0	1	1(0+1)
04MSC19102	M.Sc. RESEARCH	2	15	15(0+15)
04MSC19301	Discipline & Co. curricular activity	0	1	1(0+1)
Total		0	17	17