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**B.Sc. (Horticulture)
New Syllabus
Semester -III**

Sr. No.	Course No.	Course title	Credits
1	H/FS-231	Tropical & Subtropical Fruits	2+1=3
2	H/VIS-231	Tropical and Sub-tropical Vegetables	2+1=3
3	H/PHT-231	Post harvest Management of Horticultural Crops	2+1=3
4	H/SPICON-231	Spices and Condiments	1+1=2
5	H/FL-232	Landscape Gardening	1+1=2
6	H/AGRO-232	Weed Management in Horticultural Crops	1+1=2
7	H/PATH-232	Diseases of Vegetables, Ornamentals and Spice Crops	2+1=3
8	H/SSAC-233	Fundamentals of Biochemistry	1+1=2
		Total	12+8=20

Course No. : H/FS-231
Course title : Tropical and Sub-Tropical Fruits

Credits : 3(2+1)
Semester : III

Theory :

Horticultural classification of fruits. Horticultural zones of India importance and scope of tropical and sub-tropical fruit crops, 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, and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, grapes, citrus, papaya, sapota, guava, pineapple, Litchi, fig. and pomegranate. Bearing habits in mango and citrus, causes and control measures of special production problems, alternate and bearing in mango and citrus, overcome, control measures., 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 pomegranate fig, and citrus. Selection of site and planting system, pre-treatment of banana suckers, desuckering and propping 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.

Books recommended :

1. Bose, T.K. (1985): Fruits of India : Tropical and Sub-tropical fruit crops.
2. Shanmugavelu, K.G. (1989) : Production technology of fruit crops, Oxford and IBH, New Delhi.
3. Cheema, G.S.S.S. Bhat and K.C. Naik (1954) : Commercial fruits of India. Mc.Millan and Co. Calcutta.
4. Singh Sham, S. Krishnamurthy and S.L. Katyal (1963) : Fruit culture in India, ICAR New Delhi-1.
5. Singh Rajjit (*1969): Fruits National Books Trust, New Delhi.

Course No. : H/FS-231
 Course title : Tropical and Sub-Tropical Fruits

Credits : 3(2+1)
 Semester : III

Lesson plan - Theory

Lecture No.	Topic	Weightage
1 & 2	Horticultural classification of fruits.	10
3 & 4	Horticultural zones of India, importance and scope of tropical and subtropical fruit crops.	10
5	Detail study of area, production and export potential of tropical and subtropical fruit crops.	10
	Varieties, climate and soil requirement, propagation techniques, planting density and systems, after care training and pruning. Management of water, nutrients and weeds, special horticultural techniques including plant growth regulators and use in commercial orchards. Physiological disorders, post harvest technology, harvesting indices, harvesting methods, grading, packaging and storage of following crops.	30
6, 7 & 8	Mango	
9, 10 & 11	Banana	
12, 13 & 14	Grapes	
15 & 16	Citrus	
17 & 18	Papaya	
19 & 20	Sapota	
21	Guava	
22	Pineapple	
23	Litchi	
24	Fig	
25	Pomegranate	
26	Bearing habits in mango and citrus.	
27	Causes and control measures of special production problems in mango and citrus.	20
28	Alternate bearing in mango and citrus and measures to overcome these problems.	
29	Citrus decline – causes and management.	
30	Bud forecasting in grapes.	
31	Sex expression and seed production in papaya.	
32	Latex extraction crude papain production and economics of production.	

Course No. : H/FS-231
 Course title : Tropical and Sub-Tropical Fruits

Credits : 3(2+1)
 Semester : III

Lesson Plan - Practical

Prac. No.	Topics
1 & 2	Description and identification of varieties based on flower and fruit morphology
3	Selection of site and planting system
4 & 5	Training and pruning of grapes, mango, guava, citrus, pomegranate and fig.
6 & 7	Pre-treatment of banana suckers, desuckering and propping in banana.
8	Sex forms in papaya
9	Seed production in papaya latex extraction and preparation of crude papain
10	Use of plastics in fruit production
11	Preparation and use of plant growth regulator in fruit crops.
12	Manure and fertilizer application including biofertilizer.
13	Study of ripening of fruits, grading and packaging etc.
14	Production economics of fruit crops
15 & 16	Visit to commercial orchards and diagnosis of maladies.

Course No. : H/VS-231
Course title : Tropical and Sub-Tropical Vegetables

Credits : 3(2+1)
Semester : III

Theory :

Importance and scope of tropical and sub tropical vegetable and tuber crops, Area, production, export potential of tropical and sub-tropical vegetable and tuber crops, vegetable farming and its types. Climate and soil requirements, seed rate, land preparation, Raising of nursery, transplanting of vegetable crops and planting for directly sown/ transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management, improved varieties and hybrids, deficiencies, physiological disorder use of growth regulators harvesting, grading, storage and yield economic crops and marketing of tomato, brinjal, chilli, capsicum okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, dolichos bean, cucurbits, moringa, curry leaf, agathi, portulaca and basella, sweet potato, colocasia, dioscorea, amorphophallus xanthosoma, tapioca.

Practical:

Identification and description of tropical and sub-tropical vegetable crops; raising of nursery and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable crop, method of application of manures fertilizers, method of irrigation and intercultural operation; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards. Harvesting, grading and storage, marketing, (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation and field visit to commercial farms.

Books recommended :

1. Thamburaj, S. (2005), Vegetable, tuber and spices ICAR, Publication, New Delhi.
2. Niraj, N.P.(2006) : Basic concept of vegetable science IBDC, Lucknow.
3. Singh, S.P. (2005) : Production technology of vegetable crops. ARCC, Hisar.
4. Bose, T.K. and M.G.Som (2005) Vegetable crops in India Naya Prokesh, Kolkatta.
5. Vegetables -B. Choudhury
6. Vegetable crops - T.K.Bose, M.G. Som, and T. Kabir
7. Hand Book of Horticulture -K.L. Chadha (ICAR Publication)

Course No. : H/VS-231
 Course title : Tropical and Sub-Tropical Vegetables

Credits : 3(2+1)
 Semester : III

Lesson plan - Theory

Lecture No.	Topic	Weightage
1	Introduction, scope and importance of vegetable and tuber crops	5
2	Area, production, economic importance and export potential of tropical and subtropical vegetables and tuber crops.	5
3	Types of vegetable farming	5
4-9	Production technology of vegetable crops Viz. Fruit vegetables: Tomato, Brinjal, Chilli, Okra, Capsicum	20
10-16	Cucurbits: Pumpkin, Cucumber, Bottle gourd, bitter gourd, ridge gourd, sponge gourd, water melon, and musk melon.	20
17-20	Beans: French bean, Cluster bean, Cow pea, Dolichus bean	5
21	Leafy vegetables: Amaranthus	5
22-27	Tuber crops- sweet potato, colocasia, dioscoria, Amarpophyllus, xanthosoma, tapioca	20
28-29	Perennial vegetables: Moringa, Curry leaf, Agathi	5
30-31	Physiological disorders in vegetable crops	5
32	Recommendations of JOINT AGRESCO for last five years	5

Practical

Practical No	Topics
1-2	Identification of vegetable crops
3-4	Nursery management- Raising vegetable seedlings
5	Field preparation and lay out for vegetable crops
6	Seed treatment and sowing of vegetable crops.
7	Transplanting of vegetable crops
8	Use of weedicides in veg crops.
9	Methods of irrigation and manuring
10	Use of plant growth regulators in veg. production.
11	Identification of nutritional deficiencies in veg. crops and remedies.
12	Identification of physiological disorders in veg. crops.
13	Harvesting indices and maturity standards.
14	Harvesting of vegetables.
15	Packaging, and storage of vegetable crops.
16	Project preparation and cost of cultivation of any two vegetables

Course No. : H/ PHT-231

Credits : 3(2+1)

Course title : Post Harvest Management of Horticultural
Crops

Semester : III

Theory :

Importance and present status of post harvest technology in horticultural crops in India and Maharashtra. Maturity, types of maturity and factors affecting maturity of horticultural crops. Maturity indices of fruits and vegetables Harvesting grading and handling of fruit, vegetables and cut flowers. Maturity indices of cut flowers, rose, gerbera, carnation, anthurium, lily, tuberose, chrysanthemum. Harvesting, grading, handling of above cut flowers. Maturity indices, harvesting, grading, handling of medicinal and aromatic plants. Pre-harvest factors affecting post harvest quality of horticultural crops. Handling of commodity before packaging. Physiological and biochemical changes during ripening of fruits. Ripening of fruits, role of ethylene. Hastening and delaying ripening process. Post harvest treatments of horticultural crops to increase the shelf life. viz. disinfection treatments like VHT, Hot water treatment fungicidal chemical irradiation etc. Quality parameters & specification of fruits, vegetables and flowers for export. Methods of storage for local and export market. Packaging- importance, methods and types, cushioning.

Practical :

Maturity indices of fruits and vegetables. Maturity indices of cut-flowers and loose flowers. Determination of PLW in fruits and vegetables including quality deterioration. Grading of fruits, vegetables and cut flowers. Post harvest treatments of fruits and vegetables. Artificial ripening of fruits. Post harvest treatments of cut flowers to increase vase life. Packaging studies in fruit and vegetables. Packaging studies in cut flowers and plantation crops. Studies of storage methods- zero energy cool chamber (installation). Studies on zero energy cool chamber, storage of fruits and vegetables. Post harvest disorders in fruits and vegetables

Books recommended :

- 1 R.P. Shrivastava and Sanjeev Kumar Fruit and vegetable preservation – principles and practices.
- 2 Giridhari Lal, Sidhappa and G.L. Tandon (1986) – Fruit and vegetable preservation ICAR, New Delhi.
- 3 FAO: Fruit and Vegetable processing, International book distributing Co. Lucknow-226 004.
- 4 Cruess, W.V. Commercial fruit and vegetable products. Mac. Graw- Hill Book Co. New York.
- 5 Pantastico ERB (1975) Post harvest physiology, handling of tropical & subtropical fruits and vegetables
- 6 Salunkhe D.K. and Desai B.B. (1984) Post harvest biotechnology of vegetables, Vol 1&2 (RC Press, Inc, Boca Raton, Florida)
- 7 Weichmann, J (1987) post harvest physiology of vegetables
- 8 Wills RBH. Post harvest- An introduction to the physiology & handling of fruits and vegetables
- 9 Ryall and W.T. Pentzer (1974) Handling, Transportation and storage of fruits and vegetable, Vol 1&2
- 10 Salunkhe D.K. and Bhat- Post harvest physiology, Biotechnology of flowers
- 11 Post harvest handling of fruits and vegetables by Bal and Sandhu.
- 12 Post harvest physiology of fruits by S.K. Mitra, CAB International pub. House.

Course No. : H/ PHT-231

Credits : 3(2+1)

Course title : Post Harvest Management of Horticultural Crops

Semester : III

Lesson plan - Theory

Lecture No.	Topic	Weightage
1 & 2	Importance and present status of post harvest technology in horticultural crops in India and Maharashtra.	5
3	Maturity, types of maturity and factors affecting maturity of horticultural crops.	5
4 & 5	Maturity indices of fruits and vegetables	10
6 & 7	Harvesting grading and handling of fruit and vegetables	10
8 & 9	Maturity indices of cut flowers, rose, gerbera, carnation, anthurium, lily, tuberose, chrysanthemum	10
10	Harvesting, grading, handling of above cut flowers	10
11 & 12	Maturity indices, harvesting, grading, handling of medicinal and aromatic plants	10
13 & 14	Pre-harvest factors affecting post harvest quality of horticultural crops.	10
15	Handling of commodity before packaging	5
16 & 17	Physiological and biochemical changes during ripening of fruits	10
18	Ripening of fruits, role of ethylene.	5
19	Hastening and delaying ripening process	5
20 & 21	Post harvest treatments of horticultural crops to increase the shelf life. viz. disinfection treatments like VHT, Hot water treatment fungicidal chemical irradiation etc.	10
22	Quality parameters & specification of fruits, vegetables and flowers for export.	5
23	Methods of storage for local and export market	5
24 & 25	Packaging- importance, methods and types, cushioning.	10
26	Recent advances in packaging viz. vacuum, shrink, grape guard packing	5
27	Pre-cooling and methods of pre-cooling	5
28	Modes of transport to local and distant markets	5
29 to 32	Cold chain – pack house operation viz., sorting, grading, waxing, degreening, fungicidal treatments etc. and Recommendations of JOINT AGRESCO of last five years.	10

Course No. : H/ PHT-231

Credits : 3(2+1)

Course title : Post Harvest Management of Horticultural Crops

Semester : III

Lesson plan - Practical

Practical No.	Topic
1	Maturity indices of fruits and vegetables
2	Maturity indices of cut-flowers, loose flowers and medicinal and aromatic plants
3	Determination of PLW in fruits and vegetables including quality deterioration
4	Grading of fruits, vegetables and cut flowers
5	Post harvest treatments of fruits and vegetables
6	Artificial ripening of fruits.
7	Post harvest treatments of cut flowers to increase vase life
8	Packaging studies in fruit and vegetables
9	Packaging studies in cut flowers and plantation crops
10	Studies of storage methods- zero energy cool chamber (installation)
11	Studies on zero energy cool chamber, storage of fruits and vegetables
12	Post harvest disorders in fruits and vegetables
13	Post harvest disorders in flowers and plantation crops
14	Identification of post harvest diseases in fruits, vegetables and spices
15	Visit to market yard and packaging houses of fruits, vegetables and cut flowers
16	Visit to cold storage units

Course No. : H/SPICON-231
 Course title : Spices and Condiments

Credits : 2(1+1)
 Semester : III

Theory :

History, scope and importance, area and production, uses, export potential and role of spices and condiments in national economy. Classification, soil and climate, propagation-seed, vegetative and micro-propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper Export Promotion Council, institutions and research centers in R&D. Crops: Cardamom, black pepper, ginger, turmeric, clove, nutmeg, kokum, cinnamon, allspice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishops weed, saffron, vanilla, thyme and rosemary.

Practical :

Identification of varieties; propagation, seed treatment - sowing; layout, planting; earthing up; manuring and use of weedicides, training and pruning; fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

Books recommended :

- 1 Introduction to spices and plantation crops by N.Kumar et al.
- 2 Spice crops of India By Prem-singh Arya
- 3 Hand book of horticulture, ICAR Publication, New Delhi
- 4 Major spices of India (Crop management), J.S.Pruthi ICAR Publication
- 5 Minor spices of condiments, J.S.Pruthi ICAR Publication

Course No. : H/SPICON-231
 Course title : Spices and Condiments

Credits : 2(1+1)
 Semester : III

Lesson plan (Theory)

Lecture No.	Topic to be covered	Weightage Marks
1	History, Importance and scope of spices and condiment crops.	5
2	Export potential and role of spices and condiments in national economy	5
	Classification, soil and climate, propagation-seed, vegetative and micro-propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper Export Promotion Council, institutions and research centers in R&D of following crops	
3	Black Pepper	10
4	Cardamom	5
5	Turmeric	10
6	Ginger	10
7	Clove and Nutmeg	10
8	Cinnamon and Kokum	10
9	Allspice and curry leaf	6
10	Coriander and Fenugreek	5
11	Fennel and Cumin	5
12	Celery and Dill	5
13	Bishop's weed and Saffron	2
14	Vanilla	5
15	Thyme and Rose merry	2
16	Recommendations of JOINT AGRESCO for last five years	5

Practical

Practical No	Topic
1-2	Identification and description of Spices and condiment crops
3-4	Identification and description of important varieties of Spices and condiment crops
5-6	Commercial methods of propagation for spices and condiment crops
7	Seed treatments and sowing of spices and condiment crops
8	Layout and planting of spices and condiment crops
9	Weed management in spices and condiment crops
10	Cultural operations viz. Training and pruning, Earthing up
11	Maturity standards and harvesting of spices and condiments
12	Grading, packaging and storage of spices and condiments
13	Extraction of essential oil from spices and condiments
14	Extraction of Oleoresins from spices and condiments
15-16	Visit to commercial plantation of spices and condiment crops

Course No. : H/FL-232
 Course title : Landscape Gardening

Credits : 2(1+1)
 Semester : III

Theory :

History, scope of gardening aesthetic values Gardens in India, types of garden Landscaping, historical background and values of landscaping Principles, basic components and elements of landscape design Plant material for landscaping symbols, tools and implements used in landscape design Layout of formal gardens, informal gardens Special types of gardens (bog garden, sunken garden, terrace garden, rock garden) Special types of gardens trees their design and walk paths, bridges, constructed features Principles of gardening, garden components, adornment, lawn making, methods of designing rockery, water garden Floriculture industry, importance, area and production industrial importance in India Green house and lath house Propagation, planting shrubs and herbaceous perennials Importance, design values, propagation, planting climbers and creepers Propagation, planting palms, ferns, grasses, cacti and succulent Flower arrangement, importance production details, cultural operations and constraints Post harvest practices, bioaesthetic planning, definition need Country planning, urban planning Planting avenues, schools and villages Beautifying railway stations, dam sites, hydro electric stations, colonies, river banks Planting material for play grounds vertical gardens and roof gardens Culture of bonsai, art of making bonsai, parks and public gardens Landscape design for specific areas

Practical :

Identification and description of annuals, herbaceous and perennials. Identification and description of climbers, creepers, foliage flowering shrubs and trees. Identification and description of palms, ferns, ornamental grasses and cacti succulents. Planning and designing gardens, layout of location of components of garden study. Functional uses of plants in the landscape. Planning design of house garden, roadside planting, avenues for new colonies, traffic islands. Preparation of land for lawn and planting. Description and design of garden structures. Layout of rockery, water garden, terrace garden, and Japanese gardens. Recreational and children's corner. Layout of terrarium, traffic islands, bottle garden, dish garden. Flower arrangement. Bonsai practicing and training. Identification and description of species/varieties of jasmine, chrysanthemum, marigold, dahlia, gladiolus, carnation, aster. Importance of inter-culture practices in jasmine, chrysanthemum, marigold, dahlia, gladiolus, carnation, aster. Visit to nearby gardens.

Books recommended :

- 1 Complete Gardening in India – Gopalswamiengar
- 2 Complete Home Gardening – Dey.S.C.
- 3 Floriculture and Landscaping – Bose.T.K.
- 4 Floriculture and Landscaping – Deshraj
- 5 Floriculture in India – Randhawa & Mukhopadhyay
- 6 Introduction to Landscaping, Design, Construction and maintenacnce – Ronald J.Biondo and Charles B.Schroeder
- 7 Landscape Gardening & Design with Plants – Supriya Kumar Bhattacharjee
- 8 Landscape principles and practices – Jack E.Ingels

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6. Modern weed control – Crafts A.S. 1975. University of California Press, California, USA.
7. Scientific Weed management – Gupta, O.P. 1984. Today and Tomarrows Publishers, New Delhi.
8. All about weed control. Subramanian S., Mohammed Ali and Jayakumar R. 1991. Kalyani Publishers, Ludhiana, India.

Practical

Ex. No.	Name of the exercise
1 and 2	Identification of weeds
3 and 4	Survey of weeds in horticultural crops and other habitats
5 and 6	Collection of weed preparation of weed herbarium
7	Calculations of weed control efficiency and weed index
8	Herbicide label information and computation of herbicide doses
9 and 10	Study of herbicide application equipments and calibration
11	Demonstration on methods of herbicide application
12	Preparation of list of commonly available herbicides
13	Study of phytotoxicity symptoms of herbicides in different crops
14	Biology of Nut sedge and Bermuda grass
15	Biology of Parthenium and Celosia
16	Economics of weed control practices
17	Tours and visits to problematic weed area

H/PATH: 232

Credits : 2+1=3

Title: Diseases of vegetable, ornamental and spice crops

Semester: III

A) Syllabus

Theory:

Symptoms, etiology, mode of spread, epidemiology and integrated management of diseases of the following vegetables, ornamental and spice crops: tomato, brinjal, chili, okra, cabbage, cauliflower, radish, knol-khol, broccoli, pea, beans, beet root, onion, garlic, fenugreek, and other leafy vegetables, ginger, potato, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, cinnamon, jasmine, rose, gerbera, crossandra, tuberose, carnation, chrysanthemum, marigold, gladiolus, geranium. Important post-harvest diseases of vegetables and ornamental crops and their management.

Practical:

Observations of symptoms, causal organisms and host parasitic relationship of important diseases, examination of cultures of important pathogens of vegetables, ornamental and spice crops.

Books recommended:

- Plant Pathology . 4th edn. By Agrios, G.N. 1997. Academic Press, New York.
 Plant Diseases. 7th Edn. By Singh, R.S. 1998. Oxford and IBH Publ., New Delhi
 Vegetable Diseases and their Control. By SherA.F. and Macanb, A.A. 1986. A Willey Int. Publ., New York.
 Diseases of Vegetable Crops. By Singh, R.S. 1973. Oxford and IBH., New Delhi.
 Diseases of Crop Plants in India. 4th Edn. 1998. By Rangaswamy G. and Mahadevan. Prentice Hall., New Delhi.
 Plant Pathology By Mehrotra, R.S. 1980. Tata McGraw-Hill Publ., New Delhi.
 Text Book of Plant Viruses. By Smith, K.M. Acad. Press., London .
 Diseases of Ornamental Plants in India by Sohi, H.S. 1992., ICAR, New Delhi.

B) Teaching (Lecture) schedule and weightages

Course No. : PATH: 232

Sr. No.	Topic	Lecture No.	Weightages/ Marks
Symptoms, etiology, mode of spread, epidemiology and integrated disease management in diseases of :			
Vegetables crops viz.,			
1	Potato, tomato	1,2,3,	10-12
2	Brinjal, chili	4,5,	06-08
3	Cabbage, cauliflower, broccoli	6,7,	08-09
4	Radish, knol-khol, beetroot	8,9,	05-06
5	Ladies finger (bhendi/okra)	10,	04-05
6	fenugreek and other leafy vegetables	11,	04-05
7	pea, beans	12,13,	05-07
8	Onion garlic	14,15,	05-06
9	Ginger, turmeric	16,17,	05-06
Ornamental crops viz.,			
10	Rose, chrysanthemum	18,19,	05-06
11	Gerbera, marigold, jasmine	20,21,	03-04
12	Gladiolus, carnation	22,23,	03-04
13	Crossandra, geranium	24,25,	03-04
Spice crops viz.,			
14	Pepper, cumin, cardamom	26,27,	05-07
15	Nutmeg, coriander, clove, cinnamon	28,29,	04-05
16	Important post-harvest diseases of vegetables and ornamental crops and their management	30,31, 32	05-06
Total		32	80-100

C) Lesson Plan

Course No. : PATH: 232

Sr. No.	Topic	Lesson No.
	Symptoms, etiology, mode of spread, epidemiology and integrated disease management in diseases of :	
	Vegetables crops viz.,	
1	Potato: Early & late blight, wart, scab, bacterial ring rot, viruses: X, Y, leaf roll, rugose, crinkle Tomato: Damping off, early & late blight, wilts: <i>Fusarial</i> , <i>Verticillium</i> , <i>Phytophthora</i> fruit rot, blossom end rot, bacterial leaf blight, virus: mosaic, spotted wilt virus, leaf roll, stunt	1, 2, 3
2	Brinjal: Damping off, wilt, <i>Alternaria</i> & <i>Phomopsis</i> blight, rust, little leaf chili: damping off, powdery mildew, dieback, <i>Churda Murda</i> , little leaf	4, 5
3	Cabbage, cauliflower, broccoli: club root, <i>Alternaria</i> blight, wilt, downy mildew, molybdenum and boron deficiency	6, 7
4	Radish: White rust Knol-khol, beetroot: Leaf spot, <i>Sclerotium</i> root rot and other diseases	8, 9
5	Ladies finger (bhendi/okra): powdery mildew, <i>Alternaria</i> , yellow vein mosaic virus	10
6	Fenugreek and other leafy vegetables: powdery and downy mildew and <i>Alternaria</i> and <i>Cercospora</i> blights	11
7	Pea: Powdery mildew, wilt, root rot, enation and necrosis virus Beans: Powdery mildew in cluster and other beans, bacterial, and <i>Alternaria</i> blight, anthracnose	12, 13
8	Onion: <i>Alternaria</i> blight, smudge, downy mildew <i>Aspergillus</i> blackening Garlic: <i>Alternaria</i> blight	14, 15
9	Ginger: Rhizome rot, <i>Colletotrichum</i> leaf spot Turmeric: <i>Taphrina</i> leaf spot, anthracnose	16, 17
	Ornamental Crops viz.,	
10	Rose: Powdery mildew, rust, die back, stem canker Chrysanthemum: Powdery mildew, leaf spot	18, 19
11	Marigold: Powdery mildew Rust, <i>Alternaria</i> Jasmine:	20, 21
12	Gladiolus, carnation: wilt, leaf spots and blight Gerbera: Powdery mildew	22, 23
13	Crossandra: Wilt Geranium: Damping off, leaf spot, blight, bacterial leaf spot, ring spot	24, 25
	Spice Crops viz:	
14	Pepper: <i>Phytophthora</i> foot rot, anthracnose, slow wilt Cumin: Wilt, powdery mildew Cardamum: Anthracnose, blight, virus diseases	26, 27
15	Nutmeg: Die back, wilt Coriander: Powdery mildew, wilt, stem gall Clove: Die back, <i>Colletotrichum</i> Cinnamom: Leaf spot, die back	28, 29
16	Important post-harvest diseases of vegetables and ornamental crops and their management.	30, 31, 32
	Total	32

D) Exercise (Practical) Schedule

Course No. : PATH: 232

- 1) Observation of symptoms, causal organisms & host parasite relationship of important diseases
- 2) Examination of cultures of important pathogens of vegetables, ornamentals and spice crop

Sr. No.	Exercise	Exercise No.
1	Club root of crucifers viz., cabbage, cauliflower	1
2	Damping off diseases of tomato, brinjal, chilli, cabbage, cauliflower, bhendi Rhizome rot of ginger, white rust of radish	2
3	Late blight of potato, tomato	3
4	Downey mildew of onion, cucurbits, fenugreek, aster	4
5	<i>Taphrina</i> leaf spot of turmeric	5
6	Ectophytic powdery mildew of cucurbits, <i>bhendi</i> , pea, beans, fenugreek, coriander, rose, cumin	6
7	Endophytic powdery mildew of cluster bean, chili	7
8	Alternaria blight of bhendi, garlic, potato, tomato, cabbage, beans, onion, jasmine	8
9	Anthraco nose of chilli, turmeric, beans, pepper, nutmeg, clove.	9
10	Fusarial wilt of tomato, brinjal, <i>bhendi</i> , pea, cabbage, crossandra, cumin, <i>Verticillium</i> wilt of brinjal, tomato	10
11	Root rots in vegetables viz., tomato, brinjal, and pea.	11
12	<i>Macrophomina</i> leaf spot in vegetables & spices viz., brinjal, pea.	11
13	Rusts of brinjal, beans, roses, jasmine and onion smudge	12
14	Bacterial wilts of brinjal, tomato. Phytoplasma diseases viz., little leaf of brinjal, aster yellows, <i>Orobanche</i> and <i>Cuscuta</i> sp. on brinjal	13
15	Virus disease of potato: mosaic - X, Y, roll and crinkle virus, viruses of tomato, cucurbits, <i>Churda-murda</i> of chilli.	14
16	Viral disease bhendi: yellow vein mosaic Pea viruses: Enations and top necrotic virus	15
17	Deficiency diseases viz., black heart of potato, boron and molybdenum deficiency in cabbage & cauliflower, important post harvest diseases of vegetables, ornamentals, spices & their management.	16
	Total	16

20

Course Title : Fundamentals of Biochemistry : B.Sc.(Hort.)

Course No. : H/SSAC-233

Semester : III

Credit : 2 (1+1)

Theory

Carbohydrates : Occurrence, classification and structure, physical and chemical properties; isomerism, optical activity, reducing property reactions with acid and alkalies , osazone formation

Lipids – definition, classification, important fatty acids , triglycerides, essential fatty acids.

Physical and chemical properties of oil/ fat, rancidity , phospholipidsits types and importance

Plant pigments – definition. Classification. Structure and function of chlorophyll and carotenoids

Sterols : definition, classification, structure, role of brassinosterols in plant

Proteins : definition, classification, function, solubility, Amino acids classification, structure, essential amino acids, properties of amino acids, different reactions like colour reactions, amphoteric nature and isomerism. Structure of proteins – primary tertiary and quaternary proteins, their properties and reactions.

Enzymes – definition, classification, mechanism of action and factors affecting enzymes action.

Co-factor and co-enzymes; vitamins and minerals as coenzymes / co-factor

Carbohydrate metabolism, glycolysis and TCA cycle

Metabolism of lipids and fatty acid biosynthesis of fatty acids

Electron transport chain, bioenergetics of glucose and fatty acid

Nucleic acid replication, transcription and translation

Practicals

Preparation of standard solution and reagents

Qualitative test for carbohydrate and protein

Estimation of starch by anthrone method

Determination of reducing and non reducing sugar by hydrolysis / FA and 1% B

Estimation of protein by Folin – Lowry method

Estimation of free fatty acids of oils and saponification value of vegetable oils

Determination of iodine number of vegetables

Estimation of ascorbic acid in citrus juice

Separation and identification of amino acids by paper chromatography's

Preparation and identification of amino acid by thin layer chromatography

Determination of chlorophyll content in leaf sample.

Teaching Schedule

Lecture No.	Topic	Weight age
1 & 2	Carbohydrates : Occurrence, classification and structure, physical and chemical properties; isomerism, optical activity, reducing property reactions with acid and alkalies , osazone formation	5
3 & 4	Lipids – definition, classification, important fatty acids , triglycerides, essential fatty acids.	3
5	Physical and chemical properties of oil/ fat, rancidity , phospholipidsits types and importance	2
6 & 7	Plant pigments – definition. Classification. Structure and function of chlorophyll and carotenoids	3
8	Sterols : definition, classification, structure, role of brassinosterols in plant	3

9 & 10	Proteins : definition, classification, function, solubility, Amino acids classification, structure, essential amino acids, properties of amino acids, different reactions like colour reactions, amphoteric nature and isomerism. Structure of proteins – primary tertiary and quaternary proteins, their properties and reactions.	5
11	Mid Term	
12 & 13	Enzymes – definition, classification, mechanism of action and factors affecting enzymes action.	5
14	Co-factor and co-enzymes; vitamins and minerals as coenzymes / co-factor	2
15	Carbohydrate metabolism, glycolysis and TCA cycle	3
16	Metabolism of lipids and fatty acid biosynthesis of fatty acids	3
17	Electron transport chain; bioenergetics of glucose and fatty acid	2
18	Nucleic acid replication, transcription and translation	4

PRACTICALS

Pract. No.	Name of practical
1-2	Preparation of standard solution and reagents
3-4	Qualitative test for carbohydrate and protein
5	Estimation of starch by anthrone method
6-7	Determination of reducing and non reducing sugar by hydrolysis / FA and FB
8	Estimation of protein by Folin – Lowry method
9-10	Estimation of free fatty acids of oils and saponification value of vegetable oils
11	Determination of iodine number of vegetables
12	Estimation of ascorbic acid in citrus juice
13-14	Separation and identification of amino acids by paper chromatography's
15-16	Preparation and identification of amino acid by thin layer chromatography
17-18	Determination of chlorophyll content in leaf sample.

H/AGRO-232 Weed Management in Horticultural Crops

2 (1+1)

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy. Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides : definition, advantages and limitation of herbicide usage in India, Herbicide : classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity of herbicides; Mode of action of herbicide : translocation and absorption, persistence and fate of herbicides. Introduction of selectivity of herbicide, Compatibility of herbicides with other agro chemicals. Weed management in major horticultural crops, shift of weed flora in cropping systems. Aquatic and problematic weeds and their control.

Practical: Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices; Tours and visits of problematic weeds areas.

Theory : Teaching Schedule

Lecture No.	Topic to be covered	Weightage (%)
1	Weeds introduction, harmful and beneficial effects of weeds.	5
2 and 3	Crop-weed association, Propagation, dissemination and classification of weeds.	7
4 and 5	Weed biology and ecology	9
6	Crop weed competition and allelopathy, Factors affecting crop weed competition.	7
7	Concept of weed prevention, control and eradication	6
8 and 9	Weed control methods- physical (mechanical)-cultural-chemical and biological methods.	9
-	Mid term examination	
10	Chemical method of weed control in horticultural crops	8
11	Integrated weed management in horticultural crops.	7
12	Herbicides advantages and disadvantages and herbicide usage in India	8
13	Classification of herbicides and their properties	7
14	Methods of herbicide application	7
15	Absorption and translocation of herbicides and factors affecting it.	7
16	Introduction to selectivity, mode of action and persistence of herbicides, Introduction to adjuvants.	6
17	Compatibility of herbicides with other agrochemicals and shift of weed flora in cropping systems, Control of aquatic and problematic weeds	7

Reference books :

1. Weed Science Principles : R. Jayakumar and R. Jagannathan (2002).
2. Weed management – Principles and Practices : Gupta O.P. (2000), Agribios, India Publication..
3. Principles of Weed Science : Rao V.S. (2000), Oxford and IBH Publishing Co., New Delhi, India.
4. Principles in Weed management : Aldrich, R.J. and Kramer R.J. (1997), Panama Publishing Corporation, New Delhi, India.
5. Weed, weedicides and weed control : Principles and Practices – Mandal R.C. (1999).

6. Modern weed control – Crafts A.S. 1975. University of California Press, California, USA.
7. Scientific Weed management – Gupta, O.P. 1984. Today and Tomorrows Publishers, New Delhi.
8. All about weed control. Subramanian S., Mohammed Ali and Jayakumar R. 1991. Kalyani Publishers, Ludhiana, India.

Practical

Ex. No.	Name of the exercise
1 and 2	Identification of weeds
3 and 4	Survey of weeds in horticultural crops and other habitats
5 and 6	Collection of weed preparation of weed herbarium
7	Calculations of weed control efficiency and weed index
8	Herbicide label information and computation of herbicide doses
9 and 10	Study of herbicide application equipments and calibration
11	Demonstration on methods of herbicide application
12	Preparation of list of commonly available herbicides
13	Study of phytotoxicity symptoms of herbicides in different crops
14	Biology of Nut sedge and Bermuda grass
15	Biology of Parthenium and Celosia
16	Economics of weed control practices
17	Tours and visits to problematic weed area