ESTABLISHED BY AN ACT OF PARLIAMENT IN 2009

तमिलनाडु केन्द्रीय विश्वविद्यालय | CUTN | தமிழ்நாடு மத்தியப் பல்கலைக்கழகம்

CENTRAL UNIVERSITY OF TAMIL NADU

M.Sc HORTICULTURE (2020-21)

CURRICULUM BOOK

Department of Horticulture

School of Life Sciences

Central University of Tamil Nadu

November 2020

M.Sc Horticulture (2020-23)

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CENTRAL UNIVERSITY OF TAMIL NADU

(Established by an Act of Parliament, 2009)

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School of Life science

Department of Horticulture

M.Sc Syllabus

A. Vision

Vision Statement of the Department

Develop world class horticulture hub which can cater to the needs of all tstakeholdersderfor the ultimate wellbeing of the society, through academic excellence, Innovativeresearch and need based extension.

B. Mission

Mission Statements of the Department

M1	Converging conventional knowledge and frontier research towards enhancing sustainability, food and nutritional security in accordance with regional, national and global priorities.
M2	Conservation, evaluation and development of plant genetic resources for climate resilience and environmental security.
M3	Devising sustainable solutions for major pre and post-production problems and constraints in horticultural crops through innovative approaches.
M4	Appraisal and enhancement of market value through forward and back-end linkages for economic security.
M5	Reaching out to the community through humanity-driven technology.

C. Program Specific Outcomes (PSO)

After five years of successful completion of the program, the students will be able to

PSO1	Evolve into postgraduates with knowledge and understanding of concepts across diverse areas in Horticulture.
PSO2	Serve as skilled human resource tailored to formulate, analyse, and resolve complex problems in horticultural crops.
PSO3	Apply the knowledge and skills acquired to cater the needs of the industry, academia, research and the society for contributing to nation-building.
PSO4	Providing and promoting consultancy services in the fields of Horticultural research, training and dissemination of information and technology.
PSO5	Utilization of the opportunities present in the market for the upliftment of society.

D. PSO to Mission Statement Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5
M1	3	3	3	3	2
M2	2	3	3	2	2
M3	3	3	3	2	2
M4	2	3	3	3	3
M5	2	3	3	3	3

0-No correlation; 1-Very less correlation; 2-Moderate correlation; 3-High correlation

E. Graduate Attributes of M.Sc. (Horticulture) Program

1. Disciplinary Knowledge: Content and pedagogical knowledge synchronised with the curriculum frameworks and policies.
2. Communication Skills: Possess clarity in conveying the ideas.
3. Critical Thinking: Capacity to apply analytical thought in the teaching and learning process.
4. Problem Solving: Participate in the educational problem solving and applying the knowledge in the day-to-day professional endeavors.
5. Cooperation: Appreciate collaboration and cooperation among stakeholders of education.
6. ICT Skills: Selecting and integrating appropriate ICT skills for professional development.
7. Ethics: Doing what is right to society.
8. Self-Directed Learning: Developing autonomy and self-regulation in teaching learning and professional development.
9. Reasoning: Ability to interpret and draw the conclusion from qualitative/quantitative data with open-mindedness.
10. Creativity: Ability to produce new ideas**.**
11. Societal and Environmental Concern: Performing an act or solving a problem with respect to societal and environmental concern.
12. Lifelong Learning: Understands the need for learning and practice throughout life.

F. Program Outcomes (PO)

On the successful completion of the program, the student will be able to

PO1	Cater the needs of line departments and horticulture based industries through the acquired knowledge in horticulture.
PO2	Apply the gained knowledge and skills in academics, research and development and contribute significantly to societal benefits.
PO3	Can be part of multidisciplinary and interdisciplinary team in providing better solutions and innovative ideas towards sustainable development.
PO4	Develop into an entrepreneur by harnessing the acquired knowledge and skills of horticulture
PO5	Emerge as an ambassador of horticulture through the service rendered to the farming community.

G. PO to PSO Mapping

	PO1	PO2	PO3	PO4	PO5
PSO1	3	3	3	3	3
PSO2	3	3	3	2	3
PSO3	3	3	3	3	2
PSO4	3	1	3	3	3
PSO5	3	3	3	3	3

0-No correlation; 1-Very less correlation; 2-Moderate correlation; 3-High correlation

M.Sc. Horticulture (Fruit Science) Programme Course Structure (72 Credits)

Sem	Compulsory Course (*) (Credits)	Major Course(m)	Supporting course (S)	Research &Seminar (R&S)	Elective Course (EC)	Minor course (Mi)	Non-credit Compulsary (NC)	Credit
I	HOR511 (2+1) HOR513 (2 +1) HOR514 (2 + 1) HOR515 (2+1)	HOR516 (2+1)	HOR512 (2+1)	Nil	Nil	Nil	**Nil**	18
II	HOR521 (2+1)	HOR522 (2+1) HFS523 (2+1) HFS524 (2+1) HFS525 (2+1)	Nil	HFS526 (0+3)	Nil	Nil	Nil	18
III	Nil	HFS614 (2+1) HFS615 (2+1)	HOR611 (2+1)	HFS616 (0+3)	LIF095 (3+0)	HOR613 (2+1)	Nil	18
IV	Nil	HFS622 (2+1)	Nil	HFS623 (0+6) HFS624 (0+6) HFS625 (0)	HVS621/ HFL621 (2+1)	Nil	HFS625 (0)	18
Total Credits:	15	24	6	18	6	**3**	**0**	**72**

Available credit :MSc - 72

M.Sc. Horticulture (Vegetable Science) Programme Course Structure (72 Credits)

Sem	Compulsory Course (*) (Credits)	Major Course(m)	Supporting course (S)	Research &Seminar (R&S)	Elective Course (EC)	Minor course (Mi)	Non-credit Compulsary (NC)	Credit
I	HOR511 (2+1) HOR513 (2 +1) HOR514 (2 + 1) HOR515 (2+1)	HOR516 (2+1)	HOR512 (2+1)	Nil	Nil	Nil	**Nil**	18
II	HOR521 (2+1)	HOR522 (2+1) HVS523 (2+1) HVS524 (2+1) HVS525 (2+1)	Nil	HVS526 (2+1)	Nil	Nil	Nil	18
III	Nil	HVS614 (2+1) HVS615 (2+1)	HOR611 (2+1)	HVS616 (0+3)	LIF095 (3+0)	HOR613 (2+1)	Nil	18
IV	Nil	HVS622 (2+1)	Nil	HVS623 (0+6) HVS624 (0+6) HVS625 (0)	HFS621/ HFL621 (2+1)	Nil	HVS625 (0)	18
Total Credits:	**15**	24	6	18	6	3	**0**	72

Available credit :MSc - 72

M.Sc. Horticulture (Floriculture and Land Scaping) Programme Course Structure (72 Credits)

Sem	Compulsory Course (*) (Credits)	Major Course(m)	Supporting course (S)	Research &Seminar (RS)	Elective Course (EC)	Minor course (Mi)	Non-credit Compulsary (NC)	Credit
I	HOR511 (2+1) HOR513 (2 +1) HOR514 (2 + 1) HOR515 (2+1)	HOR516 (2+1)	HOR512 (2+1)	Nil	Nil	Nil	**Nil**	**18**
II	HOR521 (2+1)	HOR522 (2+1) HFL523 (2+1) HFL524 (2+1) HFL525 (2+1)	Nil	HFL526 (2+1)	Nil	Nil	Nil	18
III	Nil	HFL614 (2+1) HFL615 (2+1)	HOR611 (2+1)	HFL616 (0+3)	LIF095 (3+0)	HOR613 (2+1)	Nil	18
IV	Nil	HFL622 (2+1)	Nil	HFL623 (0+6) HFL624 (0+6)	HFS621/ HVS621 (2+1)	Nil	HFL625 (0)	18
Total Credits:	15	24	6	18	6	**3**	**0**	**72**

Available credit :MSc - 72

List of Electives:

1. LIF095: Plant Molecular Stress physiology (3+0)
2. HVS 621: Farming systems in vegetable crops (2+1)
3. HFL621: Environmental Horticulture (2+1)
4. HFS621: Industrial Horticulture (2+1)

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(ÖÕ Gãâvãž¡pQäsã{z 2009áÇç¦p^qãvp)

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www.cutn.ac.in

School of Life Science

Department of Horticulture
Regulation – 2022

Choice Based Credit System Curriculum and syllabi
2-year M.Sc. Horticulture Programme
Course Structure (72 Credits)

SEMESTER I

S.No.	Code	Course Title	Category	Periods / Week L	T	P	Total Contact Periods	Credits
Theory								
1	**HOR511**	Growth and Development of Horticultural Crops	CC	2	0	1	3	3
2	**HOR512**	Basic Statistical Methods in Agricultural Research	SC	2	0	1	3	3
3	**HOR513**	Biodiversity and Conservation of Horticultural Crops	CC	2	0	1	3	3
4	**HOR514**	Biotechnology of Horticultural Crops	CC	2	0	1	3	3
5	**HOR515**	Organic Horticulture	CC	2	0	1	3	3
6	**HOR516**	Propagation and Nursery Management in Horticultural Crops	MC	2	0	1	3	3
			Total	**12**	**0**	**6**	**18**	**18**

Types of Courses	Short Form
Compulsory course	CC
Major Course	MC
Supporting course	SC
Research & Seminar	RS
Elective Course	EC
Minor Course	Mi
Non Credit Compulsory	NC

Fruit Science

SEMESTER II

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**HOR521**	Protected Cultivation of Horticultural Crops	CC	2	0	1	3	3
2	**HOR522**	Post-Harvest Technology of Horticultural Crops	MC	2	0	1	3	3
3	**HFS523**	Tropical and Dryland Fruit Production	MC	2	0	1	3	3
4	**HFS524**	Breeding of Fruit Crops	MC	2	0	1	3	3
5	**HFS525**	Canopy Management in Fruit Crops	MC	2	0	1	3	3
6	**HFS526**	Research I and Seminar	RS	0	0	3	3	3
			Total	**10**	**0**	**8**	**18**	**18**

SEMESTER III

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**HOR611**	Laboratory Techniques, Library Information and Technical Writing	SC	2	0	1	3	3
2	**LIF095**	Plant Molecular Stress Physiology	EC	3	0	0	3	3
3	**HOR613**	Intellectual Properties Rights and Its Management in Agriculture	Mi	2	0	1	3	3
4	**HFS614**	Sub-Tropical and Temperate Fruit Production	MC	2	0	1	3	3
5	**HFS615**	Minor and Underutilized Fruit Crops	MC	2	0	1	3	3
6	**HFS616**	Research II (Field & Laboratory)	RS	0	0	3	3	3
			Total	**11**	**0**	**7**	**18**	**18**

SEMESTER IV

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**Optional HVS621/ HFL621**	*Elective Course for Other Specialization (from Vegetable Science or Floriculture* Farming Systems in Vegetable Crops Environmental Horticulture	EC	2	0	1	3	3
2	**HFS622**	Production & Breeding of Plantation and Medicinal Crops	MC	2	0	1	3	3
3	**HFS623**	Research III (Observation & Data Analysis)	RS	0	0	6	6	6
4	**HFS624**	Research IV (Interpretation & Dissertation, Viva)	RS	0	0	6	6	6
5	**HFS625**	Comprehensive Exam Qualifying Viva (Non-Credit Compulsory)	NC	0	0	0	**0**	0
			Total	**4**	**0**	**14**	**18**	**18**

VEGETABLE SCIENCE

SEMESTER II

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**HOR521**	Protected Cultivation of Horticultural Crops	CC	2	0	1	3	3
2	**HOR522**	Post-Harvest Technology of Horticultural Crops	MC	2	0	1	3	3
3	**HVS523**	Production Technology of Warm Season Vegetable Crops	MC	2	0	1	3	3
4	**HVS524**	Breeding of Vegetable Crops	MC	2	0	1	3	3
5	**HVS525**	Seed Production Technology of Vegetable Crops	MC	2	0	1	**3**	**3**
6	**HVS526**	Research I and Seminar	RS	0		3		
			Total	**10**	**0**	**8**	**18**	**18**

SEMESTER III

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**HOR611**	Laboratory Techniques, Library Information and Technical Writing	SC	2	0	1	3	3
2	**LIF095**	Plant Molecular Stress Physiology	EC	3	0	0	3	3
3	**HOR613**	Intellectual Properties Rights and Its Management in Agriculture	Mi	2	0	1	3	3
4	**HVS614**	Production Technology of Cool Season Vegetables	MC	2	0	1	3	3
5	**HVS615**	Production Technology of Underexploited Vegetable Crops	MC	2	0	1	3	3
6	**HVS616**	Research II (Field & Laboratory)	RS	0	0	3	**3**	**3**
			Total	**11**	**0**	**7**	**18**	**18**

SEMESTER IV

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**Optional HFS621/ HFL621**	*Elective Course for Other Specialization (from Fruit Science or Floriculture)* Industrial Horticulture Environmental Horticulture	EC	2	0	1	3	3
2	**HVS622**	Production & Breeding of Spices and Aromatic Crops	MC	2	0	1	3	3
3	**HVS623**	Research III (Observation & Data Analysis)	RS	0	0	6	6	6
4	**HVS624**	Research IV (Interpretation & Dissertation, Viva)	RS	0	0	6	6	6
5	**HVS625**	Comprehensive Exam Qualifying Viva (Non-Credit Compulsory)	NC	0	0	0	**0**	0
			Total	**4**	**0**	**14**	**18**	**18**

FLORICULTURE AND LANDSCAPING

SEMESTER II

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**HOR521**	Protected Cultivation of Horticultural Crops	CC	2	0	1	3	3
2	**HOR522**	Post-Harvest Technology of Horticultural Crops	MC	2	0	1	3	3
3	**HFL523**	Production Technology of Loose Flowers	MC	2	0	1	3	3
4	**HFL524**	Breeding of Flower Crops and Ornamental Plants	MC	2	0	1	3	3
5	**HFL525**	Landscaping and Ornamental Gardening	MC	2	0	1	2	2
6	**HFL526**	Research I and Seminar	RS	0		3		
			Total	**10**	**0**	**8**	**18**	**18**

SEMESTER III

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**HOR611**	Laboratory Techniques, Library Information and Technical Writing	SC	2	0	1	3	3
2	**LIF095**	Plant Molecular Stress Physiology	EC	3	0	0	3	3
3	**HOR613**	Intellectual Properties Rights and Its Management in Agriculture	Mi	2	0	1	3	3
4	**HFL614**	Production Technology of Cut Flowers	MC	2	0	1	3	3
5	**HFL615**	Turf and Turf Management	MC	2	0	1	3	3
6	**HFL616**	Research II (Field & Laboratory)	RS	0	0	3	**3**	**3**
			Total	**11**	**0**	**7**	**18**	**18**

SEMESTER IV

S.No.	Code	Course Title	Category	Periods / Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	**Optional HFS621/ HVS621**	*Elective Course for Other Specialization (from Fruit Science or Vegetable Science)* Industrial Horticulture Farming Systems in Vegetable Crops	EC	2	0	1	3	3
2	**HFL622**	CAD for Outdoor and Indoor scaping	MC	2	0	1	3	3
3	**HFL623**	Research III (Observation & Data Analysis)	RS	0	0	6	6	6
4	**HFL624**	Research IV (Interpretation & Dissertation, Viva)	RS	0	0	6	6	6
5	**HFL625**	Comprehensive Exam Qualifying Viva (Non-Credit Compulsory)	NC	0	0	0	**0**	0
			Total	**4**	**0**	**14**	**18**	**18**

Total Credit for M.Sc. Degree – 72 (*Requirement – 72*)

SEMESTER - I					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR511	Growth and Development of Horticultural Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Students would acquire knowledge on basics of growth and development of crops.	Remember
CO2	Students will understand the biochemical, physiological, genetic and molecular mechanisms during different developmental phases of horticultural crops as well as students will thoroughly understand the various bio-synthetic pathways of plant hormones	Understand
CO3	Students will be able apply the principles learnt in previous units in field level and able to assess the influence on growth pattern of crops during stressful situations.	Apply
CO4	Students will be able to analyse the impact of physical and chemical manipulation of growth and development	Analyse

b. Syllabus

Units	**Content**
LI	Growth and development- definition, parameters of growth and development, growth dynamics, morphogenesis. Environmental impact on growth and development, effect of light, photosynthesis and photoperiodism, vernalisation, effect of temperature, heat units, thermoperiodism. Assimilate partitioning during growth and development, influence of waterand mineral nutrition during growth and development, biosynthesis of auxins, gibberellins, cytokinins, abscissic acid, ethylene, brasssinosteroids, growth inhibitors, morphactins, role of plant growth promoters and inhibitors.
LII	Developmental physiology and biochemistry during dormancy, budbreak, juvenility, vegetative to reproductive interphase, flowering, pollination, fertilization and fruit set, fruit drop, fruit growth, ripening and seed development. Growth and developmental process during stress - manipulation of growthand development, impact of pruning and training, chemical manipulations in horticultural crops, molecular and genetic approaches in plant growth development.
PIII	Understanding dormancy mechanisms in seeds, tubers and bulbs and stratification of seeds, tubers and bulbs, visit to arid, subtropical and temperate horticultural zones to identify growth and development patterns, techniques of growth analysis, evaluation of photosynthetic efficiency under different environments, study of growth regulator functions, hormone assays, understanding ripening phenomenon in fruits and vegetables, study of impact of physical manipulations on growth and development, study of chemical manipulations on growth and development, understanding stress impact on growth and development.
	Tasks and Assignments: **Task:** Students will be given with the task of analysing the growth pattern of different horticultural crops under normal and stressful situations.

Assignment:
Individual students will be assigned with a specific topic relevant to the course and will be asked to collect pertinent material, organize the material and present.

References:

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4. Leoplod AC &Kriedermann PE. 1985. Plant Growth and Development. 3 rd Ed. McGraw-Hill.
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8. Fruits of warm climate (Julia F. Morton). Published by Echo Point Books and Media, 2013 Introduction to fruit crop by Mark Rieger. Published by Taylor and Francis, 2006
9. 9. Pest of fruit crops (a colour Handbook) 2 nd edition by David. V. Alford. Published by CRC press, 201

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3
CO2	2	2	3	3	3
CO3	3	3	3	2	2
CO4	2	2	2	2	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	15	15	15	15	60
Total	**25**	**25**	**25**	**25**	**100**

SEMESTER - I					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR512	Basic Statistical Methods in Agricultural Research	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	To make students familiarize in acquiring data through observation and arranging the data through observation and arranging the data in presentable way	Understand
CO2	To make students aware of basic statistical tools available for simple analysis	Understand
CO3	To familiarize the students with different types of experimental designs available	Apply
CO4	To train them in the analysis and the interpretation and each experimental analysis	Analyze

b. Syllabus

Units	**Content**
LI	Classification, tabulation and graphical representation of data. Levels of measurement. Descriptive statistics. Theory of probability. Random variable and mathematical expectation. Probability distributions: Binomial, Poisson, Normal distributions and their applications. Concept of sampling distribution: t, χ2 and F distributions. Tests of significance based on normal, t, χ2 and F distributions. Non-parametric tests. Correlation and regression: Correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, simple and multiple linear regression model. Estimation of parameters. Coefficient of determination. Introduction to multivariate analytical tools: Principal component analysis and cluster analysis.
LII	Planning of an experiment and basic principles of design of experiments. Analysis of variance. Completely randomized design (CRD), Randomized complete block design (RCBD), Latin square design (LSD). Randomization procedure, analysis and interpretation of results. Concept of factorial experiments. Planning of sample surveys. Sampling vs complete enumeration, Simple random sampling, Stratified sampling. Practicals Unit III Descriptive statistics. Exercises on probability distributions. Correlation and regression analysis. Large sample tests, testing of hypothesis based on χ2, t and F. Exercises on non-parametric tests. Principal component analysis and cluster analysis. Analysis of data obtained from CRD, RBD, LSD. Analysis of data of factorial experiments. Selection of a random sample, estimation using simple random sampling. Exercises on stratified sampling.
PIII	Descriptive statistics. Exercises on probability distributions. Correlation and regression analysis. Large sample tests, testing of hypothesis based on χ2, t and F. Exercises on non-parametric tests. Principal component analysis and cluster analysis. Analysis of data obtained from CRD, RBD, LSD. Analysis of data of factorial experiments. Selection of a random sample, estimation using simple random sampling. Exercises on stratified sampling.

References:

1. Campbell, R.A. 1974. Statistics for Biologists. Cambridge University Press.
2. Cochran, W.G. and Cox, G.M. 1957. Experimental Designs. John Wiley.
3. Cochran, W.G. 1959. Sampling Techniques. John Wiley.
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c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	3	3	3	2
CO3	3	3	3	2	2
CO4	3	3	3	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	10	12	20	18	60
Total	**20**	**22**	**30**	**28**	**100**

SEMESTER – I					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR513	Biodiversity and Conservation of Horticultural Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Elucidate importance & significance of global biodiversity & its preservation	Understand
CO2	Illustrate various techniques of germplasm conservation & documentation	Apply
CO3	Inspect the biodiversity concepts	Analyze
CO4	Assess an ecological understanding using digital tool	Skill

b. Syllabus

Units	**Content**
LI	Biodiversity and conservation; issues and goals, centers of origin of cultivated fruits; primary and secondary centers of genetic diversity. Present status of gene centers; exploration and collection of germplasm; conservation of genetic resources – conservation in situ and ex situ.
LII	Germplasmconservation-problemofrecalcitrancy-coldstorageofscions, tissue culture, cryopreservation, pollen and seed storage; inventory of germplasm, introduction of germplasm, plant quarantine. Intellectual property rights, regulatory horticulture. Detection of genetic constitution of germplasm and maintenance of core group. GIS and documentation of local biodiversity, Geographical indication. Mango, sapota, citrus, guava, banana, papaya, grapes, jackfruit, custard, apple, ber, aonla, malus, Prunussp, litchi, nuts, coffee, tea, rubber, cashew, coconut, cocoa, palmyrah, arecanut, oil palm and betelvine.
PIII	Documentation of germplasm-maintenance of passport data and other records of accessions; field exploration trips, exercise on ex situ conservation–cold storage, pollen/seed storage, cryopreservation, visits to National Gene Bank and other centers of PGR activities. Detection of genetic constitution of germplasm, core sampling, germplasm characterization using molecular techniques. Visit of NBPGR, New Delhi and Barapani, Meghalaya.
	Tasks and Assignments: Each student is required to submit the following: ✓ Submit detailed report of visit to some national gene banks (like NBPGR) & other centers of PGR activities. ✓ Prepare & submit records of documentation made after core sampling. ✓ Formulate detailed lab report (with picturised documentation) on germplasm characterization using molecular aids. ✓ Survey the status of PGR by field excursions followed by using some model questionnaire. **References:** 1. Peter KV & Abraham Z. 2007. Biodiversity in Horticultural Crops. Vol. I. Daya Publ. House. 2. Frankel OH & Hawkes JG. 1975. Crop Genetic Resources for Today and Tomorrow. Cambridge University Press. 3. Peter KV. 2008. Biodiversity of Horticultural Crops. Vol. II. Daya Publ. House.

	4. Tropical fruit tree diversity (good Practices for in-situ an on-frarm conservation) edited by BhuwanSlhapit, Hugo. A. H. Lamers, V. RamanathaRao and Arwein Bailey. First published by Routledge, 2Park Square, Milton Park,Abingdon, Oxon OX14 4RN and By Routledege 711rd Avenue , New York, NY 10017

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – I					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR514	Biotechnology of Horticultural Crops	2	0	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO 1	Students had imparted knowledge on basic and applied aspects of plant biotechnology.	Understand
CO 2	Students informed about use of bioreactors and in- vitro methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues, ex vitro, establishment of tissue cultured plants.	Apply
CO 3	Students were exposed to various Micro-propagation – principles and concepts, commercial exploitation in horticultural crops.	Analyze
CO 4	Hands on training on tissue culture methods, various standardizing media for embryo and ovule culture were provided	Skill

b. Syllabus

Units	**Content**
LI	Harnessing bio-technology in horticultural crops, influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture. Callus culture – types, cell division, differentiation, morphogenesis, organogenesis, embryogenesis. Use of bioreactors and in vitro methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues, ex vitro, establishment of tissue cultured plants. 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.
LII	Physiology of hardening - hardening and field transfer, organ culture, meristem, embryo, anther, ovule culture, embryo rescue, somaclonal variation, protoplast culture and fusion. Construction and identification of somatic hybrids and cybrids, wide hybridization, in vitro pollination and fertilization, haploids, in vitro-mutation, artificial seeds, cryopreservation, rapid clonal propagation, genetic engineering in horticulture crops, use of molecular markers. In vitro selection for biotic and abiotic stress, achievements of biotechnology in horticultural crops.
PIII	An exposure to low cost, commercial and homestead tissue culture laboratories, media preparation, inoculation of explants for clonal propagation, callus induction and culture, regeneration of plantlets from callus, sub-culturing, techniques on anther, ovule, embryo culture, somaclonal variation, in vitro mutant selection against abiotic stress, protoplast culture, fusion technique, development of protocols for mass multiplication, project development for establishment of commercial tissue culture laboratory. Hardening – case studies, micropropagation, explant preparation, media preparation, culturing – in vitro clonal propagation, meristem culture, shoot tip culture, axillary bud culture, direct organogenesis, direct and indirect embryogenesis, micrografting, hardening. Visit of Biotech lab at IARI, New Delhi, HAFRP, Ranchi and private companies at Pune, Bengaluru.
	References: 1. Bajaj YPS. (Ed.).1989. Biotechnology in Agriculture and Forestry. Vol. V, Fruits. Springer. 2. Brown TA. 2001. Gene Cloning and DNA Analysis and Introduction. Blackwell Publ.

3. Chopra VL &Nasim A. 1990. Genetic Engineering and Biotechnology – Concepts, Methods and Applications.Oxford& IBH.
4. Gorden H &Rubsell S. 1960. Hormones and Cell Culture. AB Book Publ.
5. Keshavachandran R & Peter KV. 2008. Plant Biotechnology: Tissue Culture and Gene Transfer. Orient & Longman (Universal Press).
6. Keshavachandran R, Nazeem PA, Girija D, John PS & Peter KV. 2007. Recent Trends in Biotechnology of Horticultural Crops. Vols. I, II. New India Publ. Agency. 17
7. Parthasarathy VA, Bose TK, Deka PC, Das P, Mitra SK &Mohanadas S. 2001. Biotechnology of Horticultural Crops. Vols. I-III. NayaProkash.
8. Pierik RLM. 1987. In vitro Culture of Higher Plants. MartinusNijhoff Publ.
9. Skoog F & Miller CO. 1957. Chemical Regulation of Growth and Formation in Plant Tissue Culture in vitro. Symp. Soc. Exp. Biol. 11: 118-131
10. Vasil TK, Vasi M, While DNR &BeryHR.1979. Somatic Hybridization and Genetic Manipulation in Plants. Plant Regulation and World Agriculture. Planum Press.
11. Williamson R. 1981-86. Genetic Engineering. Vols. I-V. Academic Press.
12. Genetic Engineering of Horticultural Crops 1st Edition. Gyana Rout KV Peter. Elsevier (2018)
13. Biotechnology in Horticulture: Methods and Applications. Peter, K.V.New India Publishing Agency (2013)
14. Transgenic Horticultural Crops. ScorzaMouScorzaMou. Productivity PrInc (2011)

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	3	3	3	1
CO4	3	2	3	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER - I					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR515	Organic Horticulture	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Analyze the components of various organic horticultural system	Analyze
CO2	Understand the scientific concepts in sustainable horticultural practices	Understand
CO3	Assess the nutritional status of various organic inputs and their products in orchard utility	Apply
CO4	Acquaint knowledge on organic certification by several national and international agencies	Remember

b. Syllabus

Units	**Content**
LI	Organic horticulture – definition, synonyms and misnomers, principles, methods, merits and demerits. Organic farming systems, components of organic horticultural systems, different organic inputs, their role in organic horticulture, role of biofertilizers, biodynamics and the recent developments. Bioformulation-Panchagavya, amritpani, jeevamruth, beejamruth: its preparation and uses. EM technology and its impact in organic horticulture, indigenous practices of organic farming, sustainable soil fertility management, weed management practices in organic farming, biological/natural control of pests and diseases, organic horticulture in quality improvement.
LII	GAP - Principles and management, HACCP exercise, certification of organic products and systems, agencies involved at national and international levels, standards evolved by different agencies. Constraints in certification, organic horticulture and export, IFOAM and global scenario of organic movement, post-harvest management of organic produce.
PIII	Features of organic orchards, working out conversion plan, Input analysis-manures, nutrient status assessment of manures, biocomposting, biofertilizers and their application, panchagavya preparation and other organic nutrients application, methods of preparation of compost, vermicompost, green manuring, preparation of neem products and application, BD preparations and their role, EM technology and products, biological/natural control of pests and diseases, soil solarization, framework for GAP, case studies, HACCP analysis, residue analysis in organic products, documentation for certification, visit to fields cultivated under organic practices. Visit of quality control lab at YSPUH&F, Solan, IARI, New Delhi.
	Tasks and Assignments: **Reference** 1. Claude A, Vandana S, Sultan I, Vijaya L, Korah M & Bernard D. 2000. The Organic Farming Reader. Other Indian Press, Goa. 2. Gaur AC, Neblakantan S &Dargan KS. 1984 Organic Manures. ICAR. 3. Lampkin N & Ipswich. 1990. Organic Farming. Farming Press. London. 4. Lampkin NH &Padel S. 1992. The Economics of Organic Farming – AnInternationalPerspective.CABI. 5. Palaniappan&Annadurai. 2008. Organic Farming- Theory and Practise.Scientific Publ. **6.** Peter KV. 2008. (Ed.). Basics of Horticulture. New India Publ. Agency.New Delhi.

	7. Rao S. 1977. Soil Microorganism and Plant Growth. Oxford & IBH

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	1	3	3
CO3	2	3	3	3	3
CO4	3	3	3	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – I					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR516	Propagation and Nursery Management in Horticultural Crops	2	0	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO 1	Gain knowledge on principle, and factors involved in sexual and asexual means of propagation of horticultural crops.	Understand
CO 2	Gain knowledge on propagation of the horticultural crops by sexual and asexual means of propagation.	Understand
CO 3	Anatomical studies of plants developed through different propagation techniques.	Analyze
CO 4	Acquire skill in propagating of horticultural crops using different techniques.	Skill

b. Syllabus

Units	**Content**
LI	Introduction, life cycles 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. Seed quality, treatment, packing, storage, certification, testing. Asexual propagation – rooting of soft and hard wood cutting under mist by growth regulators. Rooting of cuttings in hot beds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principle and methods.
LII	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. Nursery – types, structures, components, planning and layout. Nursery management practices for healthy propagule production. Nursery and plant protection application during nursery. Nursery registration Act. Hardening plants in the nursery. Maintenance of nursery records.
PIII	Anatomical studies in rooting of cutting and graft union, construction of propagation structures, study of media and PGR. Visit to Tissue Culture labs of ICAR Institutes, NRC on citrus, Nagpur and government approved/private nurseries.
	References: 1. Hartmann HT & Kester DE. 1989. Plant Propagation – Principles and Practices. Prentice Hall of India. 2. Bose TK, Mitra SK & Sadhu MK. 1991. Propagation of Tropical and Subtropical Horticultural Crops. NayaProkash. 3. Peter KV. (Ed.). 2008. Basics of Horticulture. New India Publ. Agency. 4. Singh SP. 1989 Mist Propagation. Metropolitan Book Co. 5. Rajan S & Baby LM. 2007. Propagation of Horticultural Crops. New India Publ. Agency. 6. Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency. 7. Tropical fruits volume 1, 2 (Robert E. Paull and OdiloDaurte) copyright by CAB international. 8. Temperate horticulture (Current scenario) By D.K. Kishori, Satish K. Sharma, K.K. Pramanish. New India Publishing Agency

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	2
CO2	2	3	2	3	2
CO3	2	3	2	3	1
CO4	3	3	2	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR521	Protected Cultivation of Horticultural Crops	2	0	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO 1	Students were described with the general cultural practices (for fruit and vegetable production) such as site selection, soil preparation, plant establishment, plant nutrient management, irrigation, cold damage protection, propagation, pruning in the green houses.	Understand
CO 2	The knowledge for intelligent decision-making and problem solving involving various parameters in green houses were taught and students can utilize this experience during their employment/ consultancy in green house industry.	Apply
CO 3	Students were enriched with knowledge of Preparing a business plan proposal for various types of commercial greenhouse production systems.	Analyze
CO 4	For students seriously considering entering a vegetable production business, internship opportunities were provided through collaboration with vegetable growers in surrounding areas of Tamil Nadu.	Create

b. Syllabus

Units	**Content**
LI	Greenhouse – World scenario, Indian situation: present and future. Basics of greenhouse design, different types of structures – glasshouse, shade net, poly tunnels - Design and development of low cost greenhouse structures.
LII	Protected cultivation of Strawberry, Capsicum, Tomato, Cucumber, Melon, Lettuce, Rose, Carnation, Anthurium, Lilium and Gerbera.Precision farming, principles and concepts, enabling technologies of precision farming, GPS, CIS, Remote sensing.
PIII	Designs of greenhouse, low cost poly tunnels, nethouse- Regulation of light, temperature, humidity in greenhouses, media, greenhouse cooling systems, ventilation systems, fertigation systems, special management practices, project preparation for greenhouses, visit to greenhouses. Visit of protected structure at UAS, Dharwad, NAU, Navsari, DFR, Pune, IARI, New Delhi, IIHR, Bengaluru.
	References: 1. Aldrich RA & Bartok JW. 1994. Green House Engineering. NRAES, Riley, Robb Hall, Cornell University, Ithaca, New York. 2. Bhatcharjee BS. 1959. Rose Growing in Tropics. Thackarspink& Co. 3. Laurie A, Kiplingr DD & Nelson KS. 1968. Commercial Flower Forcing. McGraw-Hill. 4. Mears DR, Kim MK & Roberts WJ. 1971. Structural Analysis at an Experimental Cable-supported Air Inflated Green Houses. Trans. ASAE. 5. Pant V Nelson. 1991. Green House Operation and Management. Bali Publ. 6. Pradeepkumar T, Suma B, Jyothibhaskar&Satheesan KN. 2007. Management of Horticultural Crops.Parts I, II.New India Publ. Agency. 7. Singh, B. 2017. Advances in Protected Cultivation, NIPA, New Delhi 8. Gurugnanam, B. 2015. Geographic Information System, NIPA, New Delhi

	9. Singh, J. 2016. Precision Farming in Horticulture, NIPA, New Delhi 10. Kumar,D. V. and Peter, K.V. 2014. Protected Cultivation of Horticultural crops, NIPA, New Delhi.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	2	3	2
CO3	3	2	3	3	3
CO4	3	3	2	3	1

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR522	Post-Harvest Technology of Horticultural Crops	2	0	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO 1	Gaining knowledge on physiochemical changes associated with horticulture crops after harvest and management of postharvest losses.	Understand
CO 2	Gain knowledge on principles and methods of food preservation	Understand
CO 3	Able to analyse the physiochemical changes after harvest and storage	Analyze
CO 4	Able to develop skill in processing and development of processed products	Skill

b. Syllabus

Units	**Content**
LI	Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration. Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling. Treatments prior to shipment, viz., chlorination, waxing, chemicals, biocontrolagents and natural plant products. Methods of storage- ventilated, refrigerated, MA, CA storage, physical injuries and disorders. Role of Vitamins.
LII	Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juices, beverages, pickles, jam, jellies, candies. Dried and dehydrated products, nutritionally enriched products,fermented fruit beverages,packagingtechnology,processing waste management, food safety standards. Excruder Technology.
PIII	Analyzing maturity stages of commercially important horticultural crops, improved packing and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables, estimation of transpiration, respiration rate, ethylene release and study of vase life extension in cutflower using chemicals, estimation of quality characteristics in stored fruits and vegetables, cold chain management- visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products. Processing of sauces, ketchup, beverages.Analysis of curcumin. Visit to ICAR institutes like CISH, Lucknow, IARI, New Delhi, private companies at Sikkim, Tripura, Nagaon, Guwahati, IIHR, Bengaluru.
	References: 1. Bhutani RC. 2003. Fruit and Vegetable Preservation. Biotech Books.&Pareek OP.(Eds.).1996 Advances in Horticulture. Vol.IV. Malhotra Publ. House. 2. Haid NF &Salunkhe SK. 1997. Post Harvest Physiology and Handling of Fruits and Vegetables. Grenada Publ. 3. Mitra SK.1997.Post Harvest Physiology and Storage Sub-tropical Fruits.CABI. 4. Ranganna S.1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill. 5. Sudheer KP &IndiraV.2007.Post Harvest Technology of Horticultural Crops.New India Publ. Agency. 6. Willis R, McGlassen WB, Graham D & Joyce D. 1998. Post Harvest. An Introduction to the Physiology and Handling of Fruits,Vegetables and Ornamentals. CABI.

7. Tripathi, M. K. and Mangaraj, S. (2013) Advances in Food Processing Technology. Ed. 2013(1st). Pub: Narendra Publishing House, 1417, KishanDutt Street, Maliwara, Delhi110006. Rashtriya Printers Delhi, India.
8. Sharma, S. K. and Nautiyal, M. C. (2009) Postharvest Technology of Horticultural Crop, Pub: New India Publishing Agency, 101 Vikas Surya Plaza, CU Block, L.S.C. mkt, PitamPuram, New Delhi-110088. Jai Bharat Printing Press Delhi, India.22
9. Kalia, M. (2006) Postharvest Technology of vegetables, Pub: Agro-tech Publishing Academy, 124, Anand Plaza, Universuty Road, Udaipur-313001SSS.SSS printers New Delhi, India.
10. Gupta, S. (2012) Food Processing and Agro-based Industries, Pub: Engineer India Research Instt. 4499 NaiSarak, Main Road,Chawri Bazar, New Delhi-110006. Swastik Offset Delhi, India
11. Chakraverty, A., Majumdar, A. S., Raghavan, G. S. V. and Ramaswamy, H. S. (2010) Handbook of Postharvest Technology Cereals, Fruits, Vegetables, Tea and Spices, Pub: Marcel Dekker, Inc. 270, Madison Avenue, Newyork-10016. NutechPhotolithographers, United States of America.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	2
CO2	3	3	2	3	2
CO3	3	3	2	3	2
CO4	3	3	3	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

Fruit Science

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS523	Tropical and Dryland Fruit Production	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	To make the students acquaint with different Tropical and Dry land fruit crops	Remember
CO2	To make them study and practice cultivation of practices of different fruit crops	Understand
CO3	To make familiarize different cultivation problems their causes	Analyze
CO4	To empower them in managing the orchard in effective manner	Apply

b. Syllabus

Units	**Content**
LI	Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bio regulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, honeybees in cross pollination, physiological disorders causes 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.
LII	Mango, Banana, Citrus, Papaya, Guava, Sapota, Jackfruit, Pineapple.
LIII	Annonas, Avocado Aonla, Bread Fruit, Phalsa and Ber, other minor fruits of tropics
PIV	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. Visit of ICAR institute like IIHR, Bengaluru, TNAU, Coimbatore, CRIDA, CIAH, Bikaner, NRC on Citrus, Nagpur, CISH, Lucknow, SAUs like MPUAT, Udaipur, NDUAT, Faizabad, UP.
	References: 1. 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.NayaUdyog. 2. Chadha KL &Pareek OP.1996.(Eds.).Advances in Horticulture.Vols. II- IV. Malhotra Publ. House. Nakasone HY & Paul RE. 1998. Tropical Fruits. CABI. 3. PeterKV. 2008. (Ed.). Basics of Horticulture.New India Publ. Agency.Pradeepkumar T, Suma B, Jyothibhaskar&Satheesan KN. 2008. Management of Horticultural Crops.PartsI, II.New India Publ. Agency. 4. RadhaT& Mathew L. 2007. Fruit Crops.New India Publ. Agency. 5. Singh HP, Negi JP &Samuel JC. (Eds.). 2002. Approaches for Sustainable Development of Horticulture. National Horticultural Board. 6. Singh HP, Singh G, Samuel JC &Pathak RK. (Eds.).2003.Precision Farming in Horticulture.NCPAH, DAC/PFDC, CISH, Lucknow.

	7. Tropical fruits volume 1, 2 (Robert E. Paull and OdiloDaurte) copyright by CAB international. 8. Nutritional composition of fruit cultivars edited by Monique S., J. Simmonds and Victor P. Preedy. By Elsevier Academic Press, 2015 (OCoLC) 913923278. 9. Bioactives in fruit (Health benefits and functional food) Margot Skinner and Denise Hunter published by Wiley Backwell. 10. Nutritional disorders in fruit crops diagnosis and management by M. Prakash, K. Belakrishnan

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	1	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	08	20	20	12	60
Total	**18**	**30**	**30**	**22**	**100**

Course Code	Course Name	L	T	P	Credits
HFS524	Breeding of Fruit Crops	2	0	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO 1	The students will gain knowledge about the basics of fruit breeding, strength of plant genetic resources of fruit crops and their floral biology	Remember
CO 2	The students will be capable of understanding the different breeding strategies adopted for improvement of fruit crops	Understand
CO 3	The students will have hands on experience on emasculation, hand pollination, selfing and crossing techniques in different fruit crops.	Skill
CO 4	The students will able to fix the breeding objectives and device the appropriate strategy for a crop which would lead to development of a new variety / hybrid suiting the needs of farming community at large	Apply

b. Syllabus

Units	Content
LI	Theory Origin and distribution, taxonomical status - species and cultivars, cytogenetics, genetic resources, blossom biology, breeding systems, breeding objectives, ideotypes, approaches for crop improvement - introduction, selection, hybridization, mutation breeding, polyploid breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, biotechnological interventions, achievements and future thrust in the following selected fruit crops.
LII	Mango, banana, pineapple, citrus, grapes, guava, sapota, jackfruit, papaya, custard apple.Aonla, avocado, ber, mangosteen, litchi, jamun, phalsa, mulberry, raspberry, kokam,
LIII	Nuts, apple, pear, plums, peach, apricot, cherries and strawberry
PIV	Characterization of germplasm, blossom biology, study of anthesis, estimating fertility status, practices in hybridization, ploidy breeding, mutation breeding, evaluation of biometrical traits and quality traits, screening for resistance, developing breeding programme for specific traits, visit to research stations working on tropical, sub-tropical and temperate fruit improvement.
	Tasks: The students will be asked to practice on slefing and crossing techniques of different fruit crops Assignment: All the students will be assigned with special topic, and asked to present, discuss in group. **References:** 1. Bose TK, Mitra SK &Sanyol D. (Eds.). 2002. Fruits of India – Tropical and Sub-tropical. 3rdEd. Vols.I, II.NayaUdyog. 2. Chadha KL &Pareek OP. 1996.(Eds.).Advances in Horticulture.Vol.I. Malhotra Publ. House. 3. Chadha KL &Shikhamany SD. 1999. The Grape: Improvement, Production and Post-Harvest Management. Malhotra Publ. House. 4. Janick J & Moore JN. 1996. Fruit Breeding. Vols.I-III. John Wiley &Sons.Nijjar GS. 1977. (Eds.). Fruit Breeding in India.Oxford& IBH. 5. Radha T & Mathew L. 2007. Fruit Crops.New India Publ. Agency. 6. Singh S, Shivankar VJ, Srivastava AK & Singh IP. (Eds.). 2004. Advances in

	Citriculture. Jagmander Book Agency. 7. Tropical fruits volume 1, 2 (Robert E. Paull and OdiloDaurte) copyright by CAB international. 8. Temperate fruit crop breeding (Germplasm to Genomic) by James F. Hancock. Copyright b

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3
CO2	2	3	3	3	2
CO3	2	3	3	3	3
CO4	1	2	3	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	15	15	15	15	60
Total	**25**	**25**	**25**	**25**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS 525	Canopy Management in Fruit Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Remember the factors affecting canopy development in fruit crops	Remember
CO2	Understand the mechanism of canopy regulation in relation to growth, flowering, fruiting and fruit quality	Understand
CO3	Apply the scientific concepts of pruning and training in senile orchards	Apply
CO4	Assess the impacts of canopy regulation with several means with production and quality of fruits	Analyse

b. Syllabus

Units	**Content**
LI	Canopy management - importance and advantages; factors affecting canopy development.Canopy types and structures with special emphasis on geometry of planting, canopy manipulation for optimum utilization of light. Light interception and distribution in different types of tree canopies. Canopy architecture management for precision farming in fruits.
LII	Spacing and utilization of land area - Canopy classification; Canopy management through rootstock and scion. Canopy management through plant growth inhibitors, training and pruning and management practices. Canopy development and management in relation to growth, flowering, fruiting and fruit quality in temperate fruits, grapes, passion fruits, mango, sapota, guava, citrus and ber.
PIII	Study of different types of canopies, training of plants for different canopy types, canopy development through pruning, use of plant growth inhibitors, geometry of planting; study on effect of different canopy types on production and quality of fruits.
	References: 1. Chadha KL &Shikhamany SD. 1999. The Grape, Improvement, 2. Production and Post-Harvest Management.Malhotra Publ. House. 3. Pradeepkumar T, Suma B, Jyothibhaskar&Satheesan KN. 2008. 4. Management of Horticultural Crops. New India Publ. Agency 1. 5.Tropical fruits volume 1, 2 (Robert E. Paull and OdiloDaurte) copyright by CAB international. 5. Fruits of warm climate (Julia F. Morton). Pulbished by Echo Point Books and Media, 2013 2. 7.Introduction to fruit crop by Mark Rieger. Published by Taylor and Francis, 2006 8. Tropical fruit tree diversity (good Practices for in-situ an on-frarm conservation) edited by BhuwanSlhapit, Hugo. A. H. Lamers, V. RamanathaRao and Arwein Bailey. First published by Routledge, 2Park Square, Milton Park, Abingdon, Oxon OX14 4RN and By Routledege 711rd Avenue , New York, NY 10017 9. Temperate horticulture (Current scenario) By D.K. Kishori, Satish K. Sharma, K.K. Pramanish. New India Publishing A

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**2**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS526	Research I and Seminar	0	-	3	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO1	Design a research plan with proper review of literature	Analyse
CO2	Present a recent advance with critical analysis	Skill

b. Syllabus

Units	Content
PI	Review collection, documentation, Developing a research plan, Structuring a scientific report, synopsis preparation and design, Seminar designand presentation.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	0	3	0	0	0
CO2	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	Total
Internal	20	20	40
External	30	30	60
Total	**50**	**50**	**100**

Vegetable science

SEMESTER II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS523	Production Technology of Warm Season Vegetable Crops	2	0	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO 1	Understand the impact of ecophysiological aspects in production of warm season vegetables	Understand
CO 2	Apply the knowledge of skills oriented to production ofmajor tropical vegetables	Apply
CO 3	Access various deficiencies, disorders and the solutions to overcome the constraints in crop production of warm season vegetables	Analyze
CO 4	Acquaint skill for the demonstration of various plant growth substances and herbicides, seed extraction techniques	Skill

b. Syllabus

Units	**Content**
LI	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:
LII	Tomato, eggplant, hot and sweet peppers, Okra, beans, cowpea and cluster bean
LIII	Cucurbitaceous crops, Tapioca, Sweet potato, Green leafy warm season vegetables
PIV	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. Visit of ICAR institute like IIVR, Varanasi, IARI, New Delhi, CTCRI, SreeKariyam.
	References: 1. Bose TK &Som MG. (Eds.). 1986. Vegetable Crops in India. NayaProkash. 2. Bose TK, Kabir J, Maity TK, Parthasarathy VA &Som MG. 2003. Vegetable Crops. Vols. I-III. NayaUdyog. 3. Bose TK, Som MG &Kabir J. (Eds.). 2002. Vegetable Crops. NayaProkash. 4. BrownHD& Hutchison CS. Vegetable Science. JB Lippincott Co. 5. ChadhaKL&KallooG.(Eds.).1993-94.Advances in Horticulture.Vols. A. V-X.Malhotra Publ. House. 6. Chadha KL. (Ed.). 2002.Hand Book of Horticulture. ICAR. 7. Chauhan DVS.(Ed.).1986.Vegetable Production in India. Ram Prasad & Sons. 8. DecoteauDR. 2000. Vegetable Crops. Prentice Hall. 9. Edmond JB, Musser AM &Andrews FS. 1964. Fundamentals of Horticulture. Blakiston Co 10. Fageria MS, Choudhary BR & Dhaka RS. 2000. Vegetable Crops: Production Technology. Vol. II. Kalyani.Gopalakrishanan TR. 2007. Vegetable Crops.NewIndiaPubl.Agency.Hazra P &Som MG. (Eds.).1999.Technology for Vegetable Production and Improvement.NayaProkash.

11. KallooG& Singh K (Ed.). 2000. Emerging Scenario in Vegetable Research and Development. Research Periodicals & Book Publ. House.
12. Nayer NM & More TA 1998. Cucurbits.Oxford& IBH Publ. Palaniswamy& Peter KV. 2007. Tuber Crops. New India Publ. Agency.Pandey AK &MudranalayV. (Eds.). Vegetable Production in India:Important Varieties and Development Techniques.
13. RanaMK. 2008. Olericulture in India. Kalyani.
14. RanaMK. 2008. Scientific Cultivation of Vegetables. Kalyani.
15. RubatzkyVE&Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	3
CO2	2	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	2	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS524	Breeding of Vegetable Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	The students were exposed to basic concepts of genetics and plant breeding	Understand
CO2	The plant breeding methodologies and applications employed for self, cross and vegetative propagated crops were exposed.	Apply
CO3	Students were imparted with knowledge on genetic engineering and technologies like tissue-culture, GMO etc.,	Analyze
CO4	Students were deployed with different methods of plant breeding like pure line selection, mass selection, pedigree method and other hybrid crop varieties production for special crop improvement such as drought resistance, high yield, pest and disease resistance was given special emphasis.	Skill

b. Syllabus

Units	**Content**
LI	Theory Origin, botany, taxonomy, cytogenetics, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics, marker assisted breeding and QTLs, biotechnology and their use in breeding in vegetable crops-Issue of patenting, PPVFR act. of Potato, tomato, Eggplant, hot pepper, sweet pepper and okra, Peas and beans, amaranth, chenopods and lettuce
LII	Gourds, melons, pumpkins and squashes, cabbage, cauliflower, carrot, beetroot, radish, sweet potato and tapioca.
PIII	Selection of desirable plants from breeding population observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations; induction of flowering, palynological studies, selfing and crossing techniques in vegetable crops; hybrid seed production of vegetable crops in bulk. Screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population; molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques. Visit to breeding blocks.
	Tasks and Assignments: **Reference:** 1. Allard RW.1999. Principles of Plant Breeding.John Wiley &Sons.Basset MJ. (Ed.). 1986. Breeding Vegetable Crops. AVI Publ. 2. Dhillon BS, Tyagi RK, Saxena S. &Randhawa GJ. 2005. Plant Genetic Resources: Horticultural Crops. Narosa Publ. House. 3. Fageria MS, Arya PS &Choudhary AK. 2000. Vegetable Crops: Breeding and Seed Production. Vol. I. Kalyani. 4. Gardner EJ. 1975. Principles of Genetics. John Wiley &Sons.Hayes HK,

Immer FR & Smith DC. 1955. Methods of Plant Breeding. McGraw-Hill.
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10. PeterKV&PradeepkumarT.2008.GeneticsandBreedingofVegetables.Revised, ICAR.
11. RaiN&RaiM.2006.HeterosisBreedinginVegetableCrops.NewIndiaPubl.Agency
12. RamHH. 1998. Vegetable Breeding: Principles and Practices. Kalyani.SimmondsNW.1978. Principles of Crop Improvement.Longman. Singh BD. 1983. Plant Breeding.Kalyani.
13. Singh PK, Dasgupta SK &Tripathi SK. 2004.Hybrid Vegetable Development.International Book Distributing Co.
14. Swarup V. 1976.Breeding Procedure for Cross-pollinated Vegetable Crops.ICAR.
15. Heterosis Breeding in Vegetable Crops. NagendraRai and M. K. Rai. New India Publishing Agency (2006)

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	3
CO3	3	2	3	2	1
CO4	2	3	2	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS525	Seed Production Technology of Vegetable Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Basic principles and seed legislative aspects in India will be learnt by the students.	Remember
CO2	The students can understand the seed production techniques followed in self pollinated, cross pollinated and vegetatively propagated vegetable crops.	Understand
CO3	The students will be have practical exposure and develop skill on hybrid seed production in vegetable crops	Skill
CO4	The student will be turnout to be a successful seed producer and independently start seed production business.	Apply

b. Syllabus

Units	**Content**
LI	Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India.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. Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control.
LII	Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology. Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, colecrops, bulb crops, leafy vegetables, okra, vegetatively propagated vegetables.
PIII	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 offtype; methods of hybrid seed production in important vegetable seed extraction techniques; handling of seed processing and seed testing equipment; 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. Visit of ICAR institute like Directorate of Seed Research, Mau, UP, NRC on Seed Spices, Ajmer, IISR, Calicut, NHRDF, Pune.
	Reference: 1. Agrawal PK &Dadlani M. (Eds.).1992.Techniques in Seed Science and Technology. South Asian Publ. 2.Agrawal RL. (Ed.) 1997.Seed Technology.Oxford& IBH. 3. BendellPE.(Ed.) 1998.Seed Science and Technology: Indian Forestry Species. Allied Publ. 4.Fageria MS, Arya PS &Choudhary AK. 2000.Vegetable Crops: Breeding and Seed Production. Vol. I. Kalyani. 5. George RAT. 1999. Vegetable Seed Production. 2 nd Ed. CABI. 6. Kumar JC &Dhaliwal MS.1990.Techniques of Developing Hybrids in VegetableCrops.Agro Botanical Publ. 7.More TA, Kale PB &Khule BW. 1996. Vegetable Seed production Technology. Maharashtra State Seed Corp. 8.Rajan S & Baby L Markose. 2007. Propagation of Horticultural Crops. New India Publ. Agency. 9. Singh NP, Singh DK, Singh YK & Kumar V. 2006. Vegetable Seed Production

	Technology.International Book Distributing Co. 10.SinghSP.2001. Seed Production of Commercial Vegetables.Agrotech Publ. Academy. 11. Vegetable Seed Production. Raymond A. T. George. CABI Publishing; 3rd Edition (2013) 12.Seed Production Technology of Vegetables.Asati B. S and Singh Prabhakar.Daya Publishing House (2008)

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3
CO2	2	3	3	3	2
CO3	2	3	3	3	3
CO4	1	2	3	3	3

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	15	15	15	15	60
Total	**25**	**25**	**25**	**25**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS526	Research I and Seminar	0	-	3	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO1	Design a research plan with proper review of literature	Analyse
CO2	Present a recent advance with critical analysis	Skill

b. Syllabus

Units	Content
PI	Review collection, documentation, Developing a research plan, Structuring a scientific report, synopsis preparation and design, Seminar design and presentation.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	0	3	0	0	0
CO2	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	Total
Internal	20	20	40
External	30	30	60
Total	**50**	**50**	**100**

Floriculture and Landscaping

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL523	Production Technology of Loose Flowers	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Gain knowledge on aspects related to production of loose flowers	Understand
CO2	Gain knowledge on providing an inch in value addition, market and export	Apply
CO3	Develop skill in utilization of different production technological tools	Skill

b. Syllabus

Units	**Content**
LI	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 shade nets, transplanting techniques.Soil and climate requirements, field preparation, systems of planting, precision farming techniques. Water and nutrient management, weed management, training and pruning, pinching and disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM.
LII	Flower forcing and year round flowering, production for special occasions through physiological interventions, chemical regulation. 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 flowers (Nyctanthes, Tabernaemontana, ixora, lotus, lilies, tecoma, champaka, pandanus).
PIII	Botanical description of species and 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, post-harvest handling, storage and cold chain, project preparation for regionally important commercial loose flowers, visits to fields, essential oil extraction units and markets. Visits of IIHR, Bengaluru, TNAU, Coimbatore, KAU, Thrissur, BCKV, Kalyani, AAU, Jorhat.
	Reference: 1. Arora JS. 2006. Introductory Ornamental Horticulture. Kalyani.Bhattacharjee SK.2006.Advances in Ornamental Horticulture.Vols.I-VI. Pointer Publ. 2. Bose TK &Yadav LP. 1989. Commercial Flowers. NayaProkash. 3. Bose TK, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping.NayaProkash. 4. Chadha KL & ChaudhuryB.1992. Ornamental Horticulture in India.ICAR. 5. ChadhaKL. 1995. Advances in Horticulture. Vol. XII. MalhotraPubl.House. 6. Lauria A &RiesVH.2001.Floriculture–Fundamentals and Practices. Agrobios. 7. Prasad S & Kumar U. 2003.Commercial Floriculture.Agrobios. 8. Randhawa GS &Mukhopadhyay A.1986. Floriculture in India.Allied Publ. 9. Sheela VL. 2007. Flowers in Trade. New India Publ. Agency.ValsalaKumari PK, Rajeevan PK, Sudhadevi PK &Geetha CK. 2008.Flowering Trees.New

	India Publ. Agency. 10. De LC. 2013. Value Additions in Flowers and Orchids, Pointer Publ.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	1	3	2	2	1
CO2	2	3	2	3	2
CO3	2	3	2	3	1

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	Total
Internal	15	15	10	40
External	25	25	10	60
Total	**40**	**40**	**20**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL524	Breeding of Flower Crops and Ornamental Plants	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Elucidate integrated Gene Management (Augmentation, Evaluation, Conservation, Utilization, mutation, recombination and natural selection) which resulted in several variations in flowers	Understand
CO2	Illustrate &furnishes knowledge to beginners about the identification of resistant/tolerant donors with high floral yield potential (heterosis) against major insect-pests and pathogens	Apply
CO3	Inspect array of techniques ranging from simply selecting ornamental plants with desirable characteristics for propagation to methods that make use of knowledge of genetics and chromosomes to more complex molecular techniques	Analyze
CO4	Develop novel flower cultivars with improved floral quality and resistance/tolerance to abiotic stresses (eg. temperature [heat, cold], rains, salt concentration of soil etc.) by allele mining and discovery of new genes.	Skill

b. Syllabus

Units	**Content**
LI	Principles - Evolution of varieties, origin, distribution, genetic resources, genetic divergence- Patents and Plant Variety Protection in India. Genetic inheritance—of flower colour, doubleness, flower size, fragrance, post harvest life. Breeding methods suitable for sexually and asexually propagated flower crops and ornamental plants-- introduction, selection, domestication, polyploidy and mutation breeding for varietal development, Role of heterosis, Production of hybrids, Male sterility, incompatibility problems, seed production of flower crops**.**
LII	Breeding constraints and achievements made in commercial flowers-rose, jasmine, chrysanthemum, marigold, tuberose, crossandra, carnation, dahlia, gerbera, gladioli, orchids, anthurium, aster, heliconia, liliums, nerium. Breeding constraints and achievements made in ornamental plants – petunia, hibiscus, bougainvillea, Flowering annuals (zinnia, cosmos, dianthus, snapdragon, pansy) and ornamental foliages– Introduction and selection of plants for waterscaping and xeriscaping.
PIII	Description of botanical features – Cataloguing of cultivars, varieties and species in flowers, floral biology, selfing and crossing, evaluation of hybrid progenies, seed production-Induction of mutants through physical and chemical mutagens, induction of polyploidy, screening of plants for biotic, abiotic stresses and environmental pollution, in vitro breeding in flower crops and ornamental plants. Visit to IARI, New Delhi, YSPUH&T, Solan, HAFRP, Ranchi, PAU, Ludhiana, DFR, Pune
	Tasks and Assignments: Each student is required to submit the following: ✓ Submit detailed report of visit to some pioneer breeding research institutions.

	✓ Prepare & submit project report on development of mutants using suitable mutagens ✓ Formulate detailed lab report (with picturized documentation) on botanical description of species, cultivars and varieties. ✓ Submit the project report on *in vitro* breeding of any one commercially vital ornamental plant. **Reference:** 1. Bhattacharjee SK.2006.AdvancesinOrnamentalHorticulture.Vols.IVI.PointerPubl. 2. Bose TK &Yadav LP. 1989. Commercial Flowers. NayaProkash. 3. Chadha KL &Choudhury B.1992. Ornamental Horticulture in India.ICAR. 4. ChadhaKL.1995.AdvancesinHorticulture.Vol.XII.MalhotraPublHouse. 5. Chaudhary RC. 1993. Introduction to Plant Breeding. Oxford & IBH. Singh BD. 1990. Plant Breeding.Kalyani. 6. Singh, A.K.2015. Breeding and Biotechnology of Flowers: Set of 2 Vols. Pointer Publ

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL525	Landscaping and Ornamental Gardening	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Elucidate the importance to enter the green industry as well as provide additional professional developmental opportunities	Understand
CO2	Illustrate benefits of professional organizations in the green industry, identification and safe use of equipment, chemicals and tools	Apply
CO3	Inspect and prescribes sustainable options in horticulture which benefit the environment while maintaining productivity and economic viability	Analyze
CO4	Applies horticultural skills and knowledge to operate various business entities found in the horticultural industry	Skill

b. Syllabus

Units	**Content**
LI	Landscape designs, types of gardens, Histor y o f Landscape Gardening, English, Mughal, Japanese, Persian, Spanish, Italian, Vanams, Buddha garden; Styles of garden, formal, informal and free style gardens. Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporates. 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.
LII	Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, boggarden, sunken garden, rock garden, clockgarden, colour wheels, temple garden, sacred groves.Bioaesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, waterscaping, xeriscaping, hardscaping.
PIII	Selection of ornamental plants, practices in preparing designs for home gardens, industrial gardens, institutional 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, Visit of LalBagh, Bengaluru, IARI, New Delhi
	Tasks and Assignments: Each student is required to submit the following: ✓ Submit detailed report of visit to some model landscaped gardens. ✓ Prepare & submit project report on landscaping for different situations. ✓ Formulate reports on case studies made on commercial landscape gardens. ✓ Survey various parks and botanical gardensusing some model questionnaire.

Reference:

1. Bose, T. K, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping.NayaProkash.
2. Lauria A &Victor HR. 2001. Floriculture–Fundamentals and Practices Agrobios.
3. Nambisan KMP.1992. Design Elements of Landscape Gardening. Oxford & IBH.
4. Randhawa GS &Mukhopadhyay A. 1986.Floriculture in India. Allied Publ.
5. Sabina GT & Peter KV. 2008. Ornamental Plants for Gardens. New India Publ. Agency.
6. Valsalakumari et al. 2008. Flowering Trees.New India Publ. Agency.Woodrow MG.1999.Gardening in India.Biotech Books.
7. Roy, Rup Kumar. 2012 Fundamentals of Garden Designing: A Colour Encyclopedia. NIPA, New Delhi
8. Tiwari AK. 2016. Fundamentals of Ornamental Horticulture and Landscape Gardening, NIPA, New Delhi
9. Misra RL and Misra S. 2012.Landscape Gardening. Westville Publishing House, New Delhi

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**3**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**3**	**3**

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – II					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL526	Research I and Seminar	0	-	3	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Design a research plan with proper review of literature	Analyse
CO2	Present a recent advance with critical analysis	Skill

b. Syllabus

Units	**Content**
PI	Review collection, documentation, Developing a research plan, Structuring a scientific report, synopsis preparation and design, Seminar design and presentation.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	0	3	0	0	0
CO2	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	**CO2**	**Total**
Internal	20	20	40
External	30	30	60
Total	**50**	**50**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR611	Laboratory Techniques, Library Information and Technical Writing(s)	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	To make the students acquaint with scientific writing and to make them confident in writing the research and review article	Understand
CO2	To make students acquire technical skills in handling the Instruments, Modern lab instruments	Skill
CO3	To make him aware of Laboratory rules and regulations	Remember
CO4	To familiarize the students when the libraries system of function and make him aware of different resources including e-resources available for the retrieval and utilization	Remember

b. Syllabus

Units	**Content**
LI	Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agrochemical doses in field and pot applications.
LII	Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.). Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods
PIII	Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, water bath, oil bath. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability.
	Tasks and Assignments: **Reference:** 1. Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press. 2. Gabb MH &Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co. 3. Sadasivam and Mannickkum. 2013. Handbook of Biochemical Methods, Biotech Books

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	1	1
CO2	2	3	3	1	1
CO3	2	3	3	1	1
CO4	3	3	3	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	8	12	40
External	15	15	12	18	60
Total	**25**	**25**	**20**	**30**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
LIF095	Plant Molecular Stress Physiology	3	-	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Analyse the environmental variables that affect plant growth	Analyze
CO2	Understand stress response mechanisms and signaling pathways in plants	Understand
CO3	Apply the knowledge in assessment of stress tolerance mechanisms in plants	Apply

b. Syllabus

Units	**Content**
LI	**Introduction**: General theory of stress. Plant stress physiology fundamentals including growth regulation, phytohormones and carbon balance. The environmental variables that affect plant growth. Resources, stressors and xenobiotics. Classification of biotic and abiotic stress factors. Effect of abiotic stress factors on fundamental processes.
LII	**Stress responses**: Abiotic stress responses in plants. Stress perception at sub-cellular, cellular and organ level. Plant cell signaling. Generation of reactive oxygen species. Cellular mechanisms and regulation of photosynthesis. ROS signaling. Role of ABA in signaling. Redox regulation. Stress proteins, antioxidants, stress response mechanisms. Signal transduction and molecular mechanisms.
LIII	**Extremophilic plants**: Multiple levels of adaptation, including behavioral, morphological, anatomical, physiological, and biochemical responses. Adaptation/ acclimation of plants to extreme environments. Desiccation tolerant plants, Salt tolerant plants and heavy metal tolerant plants. Molecular mechanisms of tolerance. Crop stress physiology: Flooding. Water deficit and drought tolerance. Temperature stress. Salinity. Abiotic stress tolerance mechanisms and strategies of gene transfer in plants.
	Reference: 1. The Molecular Life of Plants. 2012. Russell Jones, Helen Ougham, Howard Thomas, and Susan Waaland. Wiley-Blackwell. ISBN-13: 978-0470870129. ISBN-10: 0470870125. 2. Biochemistry and Molecular Biology of Plants. 2002. Bob Buchanan, Wilhelm Gruissem, and Russell Jones. Wiley. ISBN-13: 978-0943088396. ISBN-10: 0943088399. 3. Plant Physiology and Development. 2014. 6th edition. Lincoln Taiz, Eduardo Zeiger, Ian Moller, and Angus Murphy. Sinauer Associates, Inc. ISBN-13: 978- 0878938667. ISBN-10: 0878938664. 4. Environmental Plant Physiology. 2016. Neil Willey, Garland Science Taylor and Francis Group, New York and London, ISBN-9780815344698 5. Physiology and Molecular Biology of Stress Tolerance in Plants. 2006.K. V. Madhava Rao, A.S. Raghavendra, and K. Janardhan Reddy, Springer, Dordrecht, Netherlands, ISBN-10 1-4020-4225-6 (e-book).

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	2	3	2	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HOR613	Intellectual Properties Right and its Management in Agriculture	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Gain knowledge on the principles and tools of IPR	Understand
CO2	Gain knowledge on the protection subject matters related to IPR	Understand
CO3	Will be able to do documentation of different IPR tools	Apply

b. Syllabus

Units	**Content**
LI	Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs. Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection.
LII	Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives, Convention on Biological Diversity.
PIII	International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.
	Reference: 1. Erbisch FH &Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI. 2. Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill. 3. Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC& Aesthetic Technologies. 4. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation. 5. Rothschild M & Scott N. (Ed.). 2003. Intellectual Property Rights inAnimal Breeding and Genetics. CABI. 6. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House. 7. The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	1	2
CO2	2	3	3	1	2
CO3	2	3	3	1	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	Total
Internal	15	15	10	40
External	25	25	10	60
Total	**40**	**40**	**20**	**100**

Fruit Science

SEMESTER –III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS614	Sub-Tropical and Temperate Fruit Production	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	The students will be acquaint with the package of practices of various subtropical and temperate fruit crops	Understand
CO2	The students will be able to analyse causes, symptoms and corrective measures of physiological disorders, nutrient deficiency, maturity indices for harvesting the crops.	Analyze
CO3	After gaining experience, they will increase farmers' income through adopting hi-tech horticulture	Apply
CO4	The students will be empowered to develop the various skills related to propagation of subtropical and temperate fruit crops	Skill

b. Syllabus

Units	**Content**
LI	Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bioregulation, abiotic factors limiting fruit production, physiology of flowering, fruit set and 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.
LII	Mangosteen, carambola, bael, wood apple, fig, jamun, rambutan, pomegranate, litchi.Loquat, persimmon, kiwifruit, strawberry, Nuts- walnut, almond, pistachio, pecan, hazelnut.
LIII	Apple, pear, quince, grapes, plums, peach, apricot, cherries
PIV	Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical, subtropical, humid tropical and temperate orchards, Project preparation for establishing commercial orchards. Visit of ICAR institutes like CITH, Srinagar, IHBT, Palampur, YSPUH&T, Solan, HP.
	Tasks and Assignments: **Task:** The students will be asked to identify the major disorders of subtropical and temperate fruit crops and asked to describe the symptoms. The students will be asked to impart themselves on commercial method of propagation of above fruit crops. **Assignment:** Every student will be assigned with a specific topic in line with the syllabus and asked to analyse the situation and required to present.

1. Reference:

1. Bose TK, Mitra SK &Sanyol D. (Ed.). 2002. Fruits of India – Tropical andSub-tropical. 3 rdEd.Vols. I, II. NayaUdyog.
2. Chadha KL & Pareek OP. 1996. (Eds.). Advances in Horticulture. Vol. I. Malhotra Publ. House.
3. Chadha KL &Shikhamany SD. 1999. The Grape: Improvement, Production and Post-Harvest Management. Malhotra Publ. House.
4. Janick J & Moore JN. 1996. Fruit Breeding. Vols.I-III. John Wiley & Sons. Nijjar GS. 1977. (Eds.). Fruit Breeding in India. Oxford & IBH.
5. Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.
6. Singh S, Shivankar VJ, Srivastava AK & Singh IP. (Eds.).2004. Advances in Citriculture. Jagmander Book Agency.
7. Tropical fruits volume 1, 2 (Robert E. Paull and OdiloDaurte) copyright by CAB international.
8. Nutritional composition of fruit cultivars edited by Monique S., J. Simmonds and Victor P. Preedy. By ElsevierAcademicPress,2015
9. Temperate fruit crop breeding (Germplasm to Genomic) by James F. Hancock. Copyright by Springer.
10. Bioactives in fruit (Health benefits and functional food) Margot Skinner and Denise Hunter published by Wiley Backwell.
11. Nutritional disorders in fruit crops diagnosis and management by M. Prakash, K. Belakrishnan, A. Rathinasamy. New India Publishing Agency
12. Fruits of warm climate (Julia F. Morton). Published by Echo Point Books and Media, 2013
13. Introduction to fruit crop by Mark Rieger. Published by Taylor and Francis, 2006
14. Pest of fruit crops (A Colour Handbook) 2nd edition by David. V. Alford. Published by CRC press, 2016 27
15. Tropical fruit tree diversity (good Practices for in-situ an on-farm conservation) edited by BhuwanSlhapit, Hugo. A. H. Lamers,V.RamanathaRao and Arwein Bailey. First published by Routledge, 2Park Square, Milton Park, Abingdon, Oxon OX14 4RN and By Routledege 711rd Avenue , New York, NY 10017
2. 16. Temperate horticulture (Current scenario) By D.K. Kishori, Satish K. Sharma, K.K. Pramanish. New India Publishing Agency

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	3	3	3	3	2
CO3	2	1	2	3	3
CO4	2	3	3	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	15	15	15	15	60
Total	**25**	**25**	**25**	**25**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS615	Minor and Underutilized Fruit Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Access the botany, taxonomy, varieties and their classification of minor fruit crops	Analyze
CO2	Understand the propagation techniques and constraints in multiplication of propagules	Understand
CO3	Apply the concepts in exploration of production and processing potentials with underutilized fruits	Apply
CO4	Remember the causes and remedies of physiological disorders, pest and diseases in minor fruit crops	Remember
CO5	Develop skills over the post-harvest handling practices of minor and underutilized fruits	Skill

b. Syllabus

Units	**Content**
LI	Importance, history, origin, area, distribution, botany, taxonomy, varieties and their classification. Climatic and soil requirements, propagation, root stocks and problem of multiplication. Establishment of orchards, planting and aftercare. Nutrition management, nutritional disorders, training, pruning, irrigation, weed control and intercropping. Exploration of production and processing potentials, Physiological disorders causes and remedies, Pest, diseases and their management, Post-harvest handling of the following crops.
LII	Bael, Durian, Rambutan, karonda,woodapple, carambola, breadfruit, Palmyra palm, Manila Tamarind
LIII	Lasoda, Langsat, Roseapple, khejri, Marking nut, Hog plum, Mulberry, Phalsa.
PIV	Study of varieties and species, Propagation methods, Planting and aftercare, Nutrient diagnosis, Study of flowering and fruit set, Identification of pests and diseases and their management. Harvesting and handling. Project preparation for establishment of commercial orchards. Visit to progressive orchards and research centre
	Tasks and Assignments: **Reference:** 1. Bose, T.K. and S.K. Mitra (ed). 1990 Tropical and Sub tropical Frits. NayaProkash, Calcutta

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**2**	**3**
CO2	**2**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS616	Research II (Field & Laboratory)	0	-	3	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO1	Conduct their research experiment with critical research appetite	Skill

b. Syllabus

Units	Content
PI	Selection of crop, preparation of field, plotting and experimental design, Introduction writing, Review of Literature collection and writing, Material and methods development, collection of chemicals and materials, Preparation of reagents, conduct of experiment.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	40	40
External	60	60
Total	**100**	**100**

Vegetable Science

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS614	Production Technology of Cool Season Vegetables	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Student had imparted knowledge on the principles of propagation and production techniques of sub-tropical and temperate vegetables.	Remember
CO2	Students analysed the of sign and symptoms for detection of pathogens and disease, integrated methods of disease management, use of biological and chemicals in disease management.	Understand
CO3	Hands on training on various propagation methods and important cultural practices for major cool season vegetables were provided.	Apply
CO4	Students gained knowledge on principles and utilization of integrated pest management of cool season vegetables	Analyse

b. Syllabus

Units	**Content**
LI	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 and seed production of: Potato, Cole crops: cabbage, cauliflower, knolkohl, sprouting broccoli, Brussels sprout
LII	Root crops: carrot, radish, turnip, Beetroot, Bulb crops: onion and garlic Peas and broad bean, green leafy cool season vegetables.
PIII	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. Visit of CPRI, Shimla, IIVR, Varanasi, IARI, New Delhi.
	Reference: 1. Bose TK &Som MG. (Eds.). 1986. Vegetable Crops in India. NayaProkash. 2. Bose TK, Som G &Kabir J. (Eds.). 2002. Vegetable Crops. NayaProkash. Bose TK, Som MG &Kabir J. (Eds.). 1993. Vegetable Crops. NayaProkash. 3. Bose TK, Kabir J, Maity TK, Parthasarathy VA &Som MG. 2003.Vegetable Crops. Vols. I-III. Naya Udyog. 4. Chadha KL &Kalloo G. (Eds.). 1993-94.Advances in Horticulture Vols. V-X. Malhotra Publ. House. 5. Chadha KL. (Ed.). 2002. Handbook of Horticulture. ICAR. 6. Chauhan DVS.(Ed.).1986.Vegetable Production in India. Ram Prasad & Sons. 7. Decoteau DR. 2000. Vegetable Crops. Prentice Hall.

8. Edmond JB, Musser AM &Andrews FS. 1951. Fundamentals of Horticulture. Blakiston Co.
9. Fageria MS, Choudhary BR & Dhaka RS. 2000. Vegetable Crops: Production Technology. Vol. II. Kalyani.
10. Gopalakrishanan TR. 2007. Vegetable Crops. New India Publ. Agency. HazraP&SomMG.(Eds.).1999.TechnologyforVegetableProductionandImprovement. NayaProkash.
11. Rana MK. 2008. Olericulture in India. Kalyani Publ.
12. Rana MK. 2008. Scientific Cultivation of Vegetables. Kalyani Publ.
13. Rubatzky VE &Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall.
14. Saini GS. 2001. AText Book of Oleri and Floriculture. Aman Publ. House.
15. Salunkhe DK &Kadam SS.(Ed.).1998. HandBook of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker.
16. Shanmugavelu KG. 1989. Production Technology of Vegetable Crops. Oxford& IBH.
17. SinghDK.2007.Modern Vegetable Varieties and Production Technology. International Book Distributing Co.
18. Singh SP.(Ed.).1989.ProductionTechnologyofVegetableCrops.Agril.Comm. Res. Centre.
19. Thamburaj S & Singh N. (Eds.). 2004. Vegetables, Tuber Crops and Spices. ICAR.
20. Thompson HC & Kelly WC.(Eds.).1978.VegetableCrops.TataMcGraw- Hill.
21. Fundamentals of Vegetable Crop Production. Beena, Singh, K.P., Chand, Prem Nair. Scientific Publishers (2014)
22. Vegetable Crops (Horticulture Science Series). T.R. Gopalakrishnan. New India Publishing Agency (2007) 22. Disease of Vegetable Crops. Shagufta. APH Publishing (2012).

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	3	3	2
CO3	3	2	3	3	2
CO4	3	3	2	3	1

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS615	Production Technology of Underexploited Vegetable Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	The students are aware of the origin and evolution of different underutilized vegetables.	Remember
CO2	The students are well versed with package of practices of underexploited vegetables so as to enhance their production.	Apply
CO3	Hands on training on various propagation methods and important cultural practices for under exploited vegetables crops were provided.	Skill

b. Syllabus

Units	**Content**
LI	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 and seed production of:
LII	Asparagus, artichoke and leek, Brussels‘s sprout, Chinese cabbage, broccoli, kale and artichoke, Amaranth, celery, parsley, parsnip, lettuce, Rhubarb, spinach, basella, bathua, (chenopods) and chekurmanis.
LIII	Elephant foot yam, lima bean, winged bean, vegetable pigeon pea, jack bean and sword bean, Sweet gourd, spine gourd, pointed gourd, Oriental pickling melon and littlegourd (kundru).
PIV	Identification of seeds; botanical description of plants; layout and planting; cultural practices; shortterm experiments of underexploited vegetables.
	Reference: 1. Bhat KL. 2001. Minor Vegetables - Untapped Potential. Kalyani. 2. lndira P & Peter KV. 1984. Unexploited Tropical Vegetables. Kerala Agricultural University, Kerala. 3. Peter KV. (Ed.). 2007-08. Underutilized and Underexploited Horticultural Crops. Vols. IIV. New India Publ. Agency. 4. Rubatzky VE & Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall 5. Srivastava U, Mahajan RK, Gangopadyay KK, Singh M &Dhillon BS. 2001. 6. Minimal Descriptors of Agri-Horticultural Crops. Part-II: Vegetable Crops. NBPGR, New Delhi.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3
CO2	3	3	2	3	1
CO3	3	2	3	2	1

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS616	Research II (Field & Laboratory)	0	-	3	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Conduct their research experiment with critical research appetite	Skill

b. Syllabus

Units	**Content**
PI	Selection of crop, preparation of field, plotting and experimental design, Introduction writing, Review of Literature collection and writing, Material and methods development, collection of chemicals and materials, Preparation of reagents, conduct of experiment.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	40	40
External	60	60
Total	**100**	**100**

Floriculture and Landscaping

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL614	Production Technology of Cut Flowers	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Elucidate the aesthetic value and economic utility of ornamental cut flowers have become an integral part of social celebrations and adornments at home and work place duo.	Understand
CO2	Illustrate modern hi-tech production techniques for cut flowers	Apply
CO3	Inspect pros and cons about physiological interventions and chemical regulations needed for off-season/year-round cut flower production	Analyze
CO4	Assess the immense entrepreneurial opportunities of cut flowers production and a way forward to earn foreign exchange (import and export)	Skill

b. Syllabus

Units	**Content**
LI	Scope of cut flowers in global trade, Global Scenario of cut flower production, Varietal wealth and diversity, area under cut flowers and production problems in India-Patent rights, nursery management, media for nursery, special nursery practices. Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soiled contamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO2 on growth and flowering
LII	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. Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation. 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: Cutrose, cut chrysanthemum, carnation, gerbera, gladioli, tuberose, orchids, anthurium, aster, liliums, bird of paradise, heliconia, alstroemeria, alpinia, ornamental ginger, bromeliads, dahlia, gypsophilla, limonium, statice, stock, cut foliages and fillers.
PIII	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, post-harvest handling, cold chain, project preparation for regionally important cut flowers, visit to commercial cut flower units and case study. Visit of NRC on Orchids, Sikkim, UAS, Dharwad, NAU, Navsari, Gujarat, KAU, Thrissur, IIHR, Bengaluru, TNAU, Coimbatore, private companies in Bengaluru, Pune, BCKV, Kalyani, AAU, Jorhat.

Tasks and Assignments:

Each student is required to submit the following:

- ✓ Submit detailed report of visit to some pioneer research institutes.
- ✓ Submit report of case studies made onvisit to some commercial cut flower units
- ✓ Formulate detailed lab report (with picturized documentation) on botanical description of species and varieties of vital commercial cut flowers.
- ✓ Project preparation for regionally important cut flowers.

Reference:

1. Arora JS. 2006. Introductory Ornamental horticulture. Kalyani. Bhattacharjee SK.2006.Advances in Ornamental Horticulture. Vols.I-VI. Pointer Publ.
2. Bose TK &Yadav LP. 1989. Commercial Flowers. NayaProkash.
3. Bose TK, Maiti RG, Dhua RS &Das P. 1999. Floriculture and Landscaping. NayaProkash.
4. Chadha KL & Chaudhury B. 1992. Ornamental Horticulture in India. ICAR.
5. Chadha KL.1995.Advances in Horticulture.Vol.XII. Malhotra Publ. House.
6. Lauria A &RiesVH.2001.Floriculture–Fundamentals and Practices. Agrobios.
7. Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios.
8. Randhawa GS & Mukhopadhyay A.1986. Floriculture in India. Allied Publ.
9. Reddy S, Janakiram B, Balaji T, Kulkarni S &Misra RL.2007. Hightech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.
10. De LC. 2013. Value Additions in Flowers and Orchids, Biotech Publishing, Jodhpur

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL615	Turf and Turf Management	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Elucidate the prospects of landscape industry	Understand
CO2	Illustrate various techniques for establishment of turf	Apply
CO3	Inspect chemical and biological properties of soil pertaining to turf grass establishment	Analyze
CO4	Assess establishment and maintenance of turfs for playgrounds using array of improved methods	Skill

b. Syllabus

Units	**Content**
LI	Prospects of landscape industry; site selection, basic requirements, site evaluation, concepts of physical, chemical and biological properties o f soil pertaining to turf grass establishment. Turf grasses-Types, species, varieties, hybrids; Selection of grasses for different locations; Grouping according to climatic requirement-Adaptation; Turfing for roof gardens.
LII	Preparatory operations; Growing media used for turf grasses - Turf establishment methods, seeding, sprigging / dibbling, plugging, sodding/turfing, turf plastering, hydro-seeding, astro-turfing. Turf management, Irrigation, nutrition, special practices, aerating, rolling, soil top dressing, use of turf growth regulators (TGRs) and micronutrients, Turf mowing-mowing equipment, techniques to minimize wear and compaction, weed control, biotic and abiotic stress management in turfs. Establishment and maintenance of turfs for playgrounds, viz. golf, football, hockey, cricket, tennis, rugby, etc.
PIII	Identification of turf grasses, Preparatory operations in turf making, Practices in turf establishment, Layout of macro and micro irrigation systems, Water and nutrient management; Special practices – mowing, raking, rolling, soil top dressing, weed management; Biotic and abiotic stress management; Project preparation for turf establishment, visit to IT parks, model cricket and golf grounds, airports, corporates, Govt. organizations; Renovation of lawns; Turf economics. Visit of IARI, New Delhi.
	Tasks and Assignments: Each student is required to submit the following: ✓ Submit detailed report on visit to some IT parks, model cricket and golf grounds, airports, corporate & Govt. organization. ✓ Submit project reports on preparation for turf establishment ✓ Formulate detailed lab report (with picturized documentation) on Identification of turf grasses. ✓ Survey turf economics using some model questionnaire.

	Reference: **1.** Nick-Christians 2004. Fundamentals of Turf grass Management. 2. Jain, Ritu and Janakiram, T. 2017. Turfing and Turf Management, NIPA, New Delhi

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	2	3	3	3	2
CO3	3	3	3	3	3
CO4	2	3	2	2	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – III					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL616	Research II (Field & Laboratory)	0	-	3	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO1	Conduct their research experiment with critical research appetite	Skill

b. Syllabus

Units	Content
PI	Selection of crop, preparation of field, plotting and experimental design, Introduction writing, Review of Literature collection and writing, Material and methods development, collection of chemicals and materials, Preparation of reagents, conduct of experiment.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	40	40
External	60	60
Total	**100**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS621	Industrial Horticulture	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Understand the importance of horticulture in industrial application and scope	Understand
CO2	Scope of horticulture in agro industries and allied sectors	Understand
CO3	Hands on experience in development of agro products	Skill

b. Syllabus

Units	**Content**
LI	Role of horticulture in industrial development at national and global level; Contribution of horticulture -economy, employment, raw material - confectionaries, food and processing industries, sugar industries, edible and non edible oils - mushroom and honey industry, natural food colourants
LII	Fortified nutri-drinks; breweries and non alcoholic beverages; pharmaceutical and neutraceutical industries; essential oils and volatiles, spice oil and oleoresins; perfumery; coir industries; timber and non timber products, compost and waste utilization industries.
PIII	Horticulture as raw material in confectionaries, food and processing industries, sugar industries, edible and non edible oils - mushroom and honey industry, natural food colourants, fortified nutri-drinks; pharmaceutical and neutraceutical industries; essential oils and volatiles, spice oil and oleoresins; perfumery; coir industries; timber and non timber products, compost and waste utilization industries

c. Mapping of Program Outcomes with Course Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	3	3
CO2	2	3	3	3	2
CO3	3	3	2	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	**CO2**	**CO3**	**CO4**	**Total**
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

Fruit Science

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS622	Production & Breeding of Plantation and Medicinal Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Students will understand practical knowledge on specialized production techniques of plantation and medicinal crops.	Understand
CO2	Students will gain hands on experience on breeding strategies followed in plantation and medicinal crops.	Skill
CO3	The students will be empowered in solving field problems.	Apply
CO4	They will become an successful entrepreneur with strong scientific and technical skills	Create

b. Syllabus

Units	**Content**
LI	Role of plantation and medicinal crops in national economy, area of production, export potential, systems of cultivation, multitier cropping, photosynthetic efficiencies of crops at different tiers, Production including temperature, light, humidity and soil pH, high density planting, nutritional requirements, role of growth regulators and macro and micronutrients, water requirements, fertigation, moisture conservation, shade regulation, weed management, training and pruning, crop regulation, maturity indices, harvesting for following Crops: Plantation crops: Coffee and Tea, Cashew, Cocoa, Rubber, Palmyrah, Oil Palm, Coconut, Arecanut and Betel Vine. Medicinal crops: Senna, Catharanthus, Medicinal solanum, Ashwagandha, Aloevera, Glort lily, Medicinal Coleus, Isabgol and poppy;
LII	Breeding objectives, approaches for crop improvement, breeding techniques and constraints for the following crops: Plantation crops: Coffee and Tea, Cashew, Cocoa, Rubber, Palmyrah, Oil Palm, Coconut, Arecanut and Betel Vine. Medicinal crops: Senna, Catharanthus, Medicinal solanum, Ashwagandha, Aloevera, Glort lily, Medicinal Coleus, Isabgol and poppy
PIII	Propagation practices of major plantation and medicinal crops, Varietal identification and description of plantation and medicinal crops; Identification, description and management strategies of nutritional and physiological disorders of plantation and medicinal crops; precision farming for plantation crops; processing methods of plantation crops; Cost benefit analysis under organic farming; Blossom biology, breeding techniques of plantation and medicinal crops. Good Agricultural practices - organic production and certification in medicinal crops.
	Tasks and Assignments:

Task:
The students will be asked to identify the major disorders, deficiency symptoms of plantation and medicinal crops and asked to describe the symptoms.
The students will be asked to impart themselves on commercial method of propagation and processing of above group of crops.

Assignment:
Every student will be assigned with a specific topic in line with the syllabus and asked to critically analyse and present.

Reference:

1. Chopra VL & Peter KV. 2005. Handbook of Industrial Crops. Panima.
2. Harler CR. 1963. The Culture and Marketing of Tea. Oxford Univ. Press.
3. Kurian A & Peter KV. 2007. Commercial Crops Technology. New India Publ. Agency.
4. Peter KV. 2002. Plantation Crops. National Book Trust.
5. Pradeep Kumar T, Suma B, Jyothibhaskar&Satheesan KN. 2008. Management of Horticultural Crops. Part I, II. New India Publ. Agency.
6. Rai PS &Vidyachandram B. 1981. Review of Work Done on Cashew. UAS, Research Series No.6, Bangalore.
7. Srivastava HC, Vatsaya B & Menon KKG. 1986. Plantation Crops – Opportunities andConstraints. Oxford & IBH.
8. Kumar N. 2018. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants.Oxford&Ibh
9. Deepa Devi N.2017. A Text Book of Medicinal and Aromatic Crops. Aavishkar Publishers. ISBN-13 : 978-8179105481
10. Farooqi Sreeramu. 2004. Cultivation of Medicinal & Aromatic Crops. Universities Press. ISBN- 13 : 978-8173715044

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	3	3	3	3	2
CO3	2	1	2	3	3
CO4	2	3	3	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	15	15	15	15	60
Total	**25**	**25**	**25**	**25**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS623	Research III (Observation & Data Analysis)	0	-	6	6

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Interpret the data obtained for the research experiment through statistical tools	Analysis

b. Syllabus

Units	**Content**
PI	Recording the results for the parameters and treatments decided and analysing the data through appropriate statistical tools

c. Mapping of Program Outcomes with Course Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	**Total**
Internal	40	40
External	60	60
Total	**100**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS624	Research IV (Interpretation & Dissertation, Viva)	0	-	6	6

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Equip with knowledge of conducting research with a high problem solving research appetite.	Remember

b. Syllabus

Units	**Content**
PI	Writing results and discussion with critical research interpretation from review of literature, compiling the Introduction, review of literature, Materials and methods, results and discussion with proper summery and conclusion in the form of thesis, Presenting the final research hypothesis to the research advisory committee and audience.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	40	40
External	60	60
Total	**100**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFS625	Comprehensive Exam Qualifying Viva (Non-Credit Compulsory)	-	-	-	-

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Acquire overall knowledge of the program by assessment	Understand

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	1	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	0	0
External	0	0
Total	**0**	**As satisfactory**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS621	Farming Systems in Vegetables	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Student had imparted knowledge on the principles of various farming systems in vegetables, basics of biocontrol, integrated farming systems and various certification procedures	Remember
CO2	The knowledge for intelligent decision-making in remote sensing data and instruments, crop simulation modelling, and operational procedures of precession plasticultures systems.	Understand
CO3	Students were enriched with knowledge of Preparing a Design, layout and assessment procedures in establishment of urban & truck vegetable garden.	Apply
CO4	For students seriously considering entering a vegetable production business, internship opportunities were provided through collaboration with vegetable growers, bio fertilizer production industries, low cost precession making instruments in surrounding areas of Tamil Nadu.	Analyse

b. Syllabus

Units	**Content**
LI	Farming systems, multitier cropping with high value vegetable crops, cover and intercropping, mixed, relay and ratoon cropping systems. Organic farming - Importance, principles and components of organicfarming system in production of Solanaceous crops, cucurbits, cole crops, root and tuber crops; Managing soil fertility, pest, disease and weed management through organic means. Role of botanicals and bio-control agents; GAP and GMP- Certification, production and export; opportunity and challenges. Climate resilient vegetable production - Building resilience in soil; adapted cultivars and cropping systems; Integrated farming and Low input vegetable farming - Primary goals & advantages, components and elements of Integrated Farming; Specialized IFS models; livestock and crop integration; manures and green manures, INM; Cost economics.
LII	Precision farming - Principles and concepts; Enabling technologies of precision vegetable farming *viz*., GPS, GIS, Remote sensing, sensors, mobile apps etc.; STCR approach for precision farming; Variability management in precision farming, mapping, variable rate technology; precision equipments, computers and robotics in precision farming; Plasticulture – Poly houses, shade net houses, Plastic mulches, drip and fertigation systems, fumigation and soil solarization. Crop Simulation modeling - Crop modeling and simulations, basic vision and objectives of modeling; potential applications and limitations; dynamic simulation models of vegetable growth and optimization of farm inputs; EFuNN model for tomato. Advanced cropping systems: Hydrophonics, Aerophonics.
PIII	Preparation and practice of composting: vermicompost, biofertilizers, bio

	pesticides, green manuring, VAM; evaluating organic crop production practices, organic soil amendment for root disease, weed management, Pest and disease managerial practices in organic farming; Visit to organic fields, various types of farming system fields and marketing centers; practice and handling of low inputs in integrated farming; precision equipments, Uses and application of crop modeling in vegetable production; practicing vegetable forcing; Design, layout and assessment procedures in establishment of urban & truck vegetable garden.
	Reference: 1. Producing Vegetable Crops by John M. Swiader& George W. Ware, Interstate Publishers, Inc., Danville, Illinois, 5th edition. 2. Vegetable Crops, Dennis R. Decoteau, Prentice-Hall, Inc., NJ Knott's Handbook for Vegetable Growers, Donald N. Maynard and George J. Hochmuth, 4th Edition. 3. Cropping Systems in Vegetables, Book: Olericulture-Fundamental of Vegetable Production Volume I, ISBN: 978-93-272-3738-2. 4. Good Agricultural Practices for greenhouse vegetable crops- FAO-http://www.fao.org/3/ai3284e.pdf. 5. Advances in Protected Cultivation by Brahma Singh, 2014, ISBN 9789383305179. 6. Wyman, J. Pellitteri, P. (n.d) Managing Insects in the Home Vegetable Garden. 7. http://www.rroij.com/open-access/integrated-farming-system--an-holistic-approach-areview.php?aid=52400 8. http://vitalysthealth.org/wp-content/uploads/2017/07/WrkBk-UrbnAgrcltr-FNL-Edited.pdf

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	3	3	2
CO3	3	2	3	3	3
CO4	3	2	3	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS622	Production & Breeding of Spices and Aromatic Crops	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Gain knowledge on the production related aspects of spices and aromatic crops.	Understand
CO2	Gain knowledge on the crop specific breeding related aspects of spices and aromatic crops.	Understand
CO3	Analyse the morphological, chemical, physiological constituents of the spices and aromatic crops.	Analyse
CO4	Hands on experience on the production, value addition and marketing of spices and aromatic crops.	Skill

b. Syllabus

Units	**Content**
LI	Introduction, importance of spices and aromatic crops - historical accent, present status- nationaland international, future prospects; climatic and soil requirements, site selection, layout, sowing/planting times and methods, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, harvesting, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of following crops:
LII	Breeding objectives, approaches for crop improvement, breeding techniques and constraints for the following crops: Spices: Black pepper, Cardamom Clove, Cinnamon and Nutmeg, Allspice, Turmeric, Ginger and Garlic, Coriander, Fenugreek, Cumin, Fennel, Ajowain, Dill, Celery, Tamarind, Garcinia and Vanilla. Aromatic crops: Ocimum, Davana, Japanese Mint, Lemon Grass, Citronella, Geranium, Rosemary, Palmarosa and Vetiver; Distillation of essential oils.
PIII	Propagation practices of major spices and aromatic crops, Varietal identification and description of spices and aromatic crops; Identification, description and management strategies of nutritional and physiological disorders of spices and aromatic crops; precision farming for plantation crops; post-harvest handling of major spice crops; Cost benefit analysis under organic farming; Good Agricultural practices - organic production and certification in spice crops. Blossom biology, breeding techniques of spices and aromatic crops. Extraction methods of essential oils from aromatic crops.
	Reference: 1. Agarwal S, Sastry EVD & Sharma RK. 2001. Seed Spices: Production, Quality, Export. Pointer Publ. 2. Arya PS. 2003. Spice Crops of India. Kalyani.

	3. Bhattacharjee SK. 2000. Hand Book of Aromatic Plants. Pointer Publ. 4. Kumar N, A, Khader P, Rangaswami&Irulappan I. 2000. Introduction to Spices, Plantation 5. Crops, Medicinal and Aromatic Plants. Oxford & IBH. 6. Nybe EV, Miniraj N & Peter KV. 2007. Spices. New India Publ. Agency. 7. Parthasarthy VA, Kandiannan V & Srinivasan V. 2008. Organic Spices. New India Publ. Agency. 8. Peter KV. 2001. Hand Book of Herbs and Spices. Vols. I-III. Woodhead Publ. Co. UK and CRC USA 9. Kumar N. 2018. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford &Ibh 10. Deepa Devi N.2017. A Text Book of Medicinal and Aromatic Crops. Aavishkar Publishers. ISBN- 13 : 978-8179105481 11. Farooqi Sreeramu. 2004. Cultivation of Medicinal & Aromatic Crops. Universities Press. ISBN-13 : 978-8173715044

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	3	3	2	2	2
CO3	3	3	2	3	2
CO4	3	3	2	3	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS623	Research III (Observation & Data Analysis)	0	-	6	6

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Interpret the data obtained for the research experiment through statistical tools	Analysis

b. Syllabus

Units	**Content**
PI	Recording the results for the parameters and treatments decided and analysing the data through appropriate statistical tools

c. Mapping of Program Outcomes with Course Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	**Total**
Internal	40	40
External	60	60
Total	**100**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS624	Research IV (Interpretation & Dissertation, Viva)	0	-	6	6

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Equip with knowledge of conducting research with a high problem solving research appetite.	Remember

b. Syllabus

Units	**Content**
PI	Writing results and discussion with critical research interpretation from review of literature, compiling the Introduction, review of literature, Materials and methods, results and discussion with proper summery and conclusion in the form of thesis, Presenting the final research hypothesis to the research advisory committee and audience.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	40	40
External	60	60
Total	**100**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HVS625	Comprehensive Exam Qualifying Viva (Non-Credit Compulsory)	-	-	-	-

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO1	Acquire overall knowledge of the program by assessment	Understand

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	1	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	0	0
External	0	0
Total	**0**	**As satisfactory**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL621	Environmental Horticulture	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Analyze the interaction of ecological and physiographic factors in horticultural crop production	Analyze
CO2	Understand the concepts of conventional ecology, native and non-native ornamental flora, ethical and non-ethical planting	Understand
CO3	Apply the principles of restoration ecology using Integrated landscape approach	Apply
CO4	Reminisce the environmental policy, law, act and legislation in India	Remember
CO5	Acquaint skills over Phyto-sociological analysis, plant associations in natural and domestic systems	Skill

b. Syllabus

Units	**Content**
LI	Introduction - interaction of ecological and physiographic factors in horticultural crop production; Role of horticulture in improving the functionality of vegetation; Thoughts and concepts of environmental horticulture *vs*. conventional ecology, native and non-native ornamental flora, ‗ethical' and ‗non-ethical' planting; Phyto-geography - changes in land use pattern and its impact on horticultural crop production - Natural resource management in horti-systems; Habitat ecology, changes in habitats and its impact on horticultural production - forest ecosystem and its evolution to a hort-ecosystem; Subsistence farming systems of the world, threat and challenges, Alternate farming systems.
LII	Challenges for environment - Environmental pollution - types, causes and effects on horti systems and their control measures. Phytoremediation - bioremediation in horticulture industry. Principles of restoration ecology using Integrated landscape approach; Landscape plant elements of restoration planning -botanical gardens & arboreta; Horticultural therapy; Global warming and Elnino - causes, effects and control measures; Green house gases – effects on productivity of horticultural crops and management strategy; carbon trading and clean development mechanism; Environmental policy, law, act and legislation in India, role of Biodiversity Board, international treaties and summit.
PIII	Phyto-sociological analysis, assessment of plant associations in natural and domestic systems, Identification & documentation of native & non-native ornamental plants, productivity assessment of various ecosystems, analysis and assessment of various phytogeographic zones, assessment of land use changes and its impact on horticultural systems, Different mechanism of phytoremediation; assessment of biodiversity, Visit to Botanical gardens & arboreta.
	Reference: 1. Ashby, M.1973. Introduction to Plant Ecology, MacMillan Press 2. CSIR. 1971. The Wealth of India. Vols.A-Z.CSIR 3. Aaubenmkire, R. F.1959. Plants and Environment. Wiley Eastern 4. Fall. 2001. Tolerance of Landscape Plants to Recycle Water Irrigation UC

and ANR Publ.
5. Mathew, I. P. &Karikari, S.K.1990. Horticulture principles and practices. MacMillan Intermediate Agricultural Series.
6. Prasad, S. & Kumar, U. 2003. Principles of Horticulture, Agrobios.
7. Sasikumar, B., Krishna Murthy, B., Rama, J., Ravindran, P.N. and Peter, K.V. (Eds).1999. Biodiversity Conservation and Utilization of Spices, Medicinal and Aromatic Plants. IISR, Calicut.
8. Singh, P.P. 2006. Perspectives in Plant Ecology and Environmental Biology. Scientific Publications
9. Haller, R.L., Kennedy, K.L. & Capra, C.L. (2019). The profession and practice of horticultural therapy. Boca Raton, FL: CRC Press.
10. Haller, R.L. & Capra, C.L. (2016). Horticultural therapy methods: Connecting people and plants in health care, human services, and therapeutic programs. (2nd ed.). Boca Raton, FL: CRC Press.
11. Simson, S.P. & Straus, M.C. (2003). Horticulture as therapy: Principles and practice. Boca Raton, FL: CRC Press.
12. Cameron, R &Hitchmough, J. (2016). Environmental Horticulture – Science and management of green spaces. CABI publisher, UK.
13. Harris, C.W. & Dines, T.N. (1988). Time-saver standards for landscape architecture. McGrawHill Education.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	3	2	2
CO3	2	3	3	3	3
CO4	3	2	3	3	3

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – IV

Course Code	Course Name	L	T	P	Credits
HFL622	Cad for Outdoor and Indoorscaping	2	-	1	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO1	Elucidate importance & applications of CAD in landscape garden designing	Understand
CO2	Illustrate 2D (AUTOCAD) & 3D (ARCHICAD) drawing techniques	Apply
CO3	Inspect dimension concepts & detail of design tools for landscape preview	Analyze
CO4	Assess plotting and accessories for designing using AUTOCAD & ARCHICAD organization tools	Skill

b. Syllabus

Units	Content
LI	Applications of CAD in landscape garden designing- 2D drawing by AUTOCAD- 3D drawing by ARCHICAD- 3D drawing by 3D MAX software- creating legends for plant and non-plant componentsbasics of photoshop software in garden designing - 2D drawing methods- AUTOCAD basics- coordinate systems in AUTOCAD LT 2007- point picking methods- toolbars and icons- file handling functionsmodifying tools- modifying comments- Isometric drawings- drafting objects**.**
LII	Using patterns in AUTOCAD drawing- dimension concepts- hyperlinking-script making- using productivity tools- e-transmit file- making sample drawing for outdoor and indoor garden by AUTOCAD 2D drawing techniques- drawing web format design- making layout - 3D drawing methods- ARCHICAD file system- tools and infobox- modification tools- structural elements- GDL objects (Grid dimensional Linking)- creation of garden components through ARCHICAD. ARCHICAD organization tools- dimensioning and detailing of designs- attribute settings of components- visualization tools for landscape preview- data management- plotting and accessories for designing- inserting picture using photoshop- making sample drawing for outdoor and indoor gardens.
PIII	Practices in point picking methods- using tool bars and icons- using modifying tools and modifying comments- isometric drawings- using productivity tools- drawing designs by AUTOCAD for home garden- institutional garden and special types of garden- using tools and info-box for 3D drawing- creation of garden components with ARCHICAD- organization- dimensioning- detailing and visualization tools with archicad- using photoshop package for 3D picture insertion- drawing designs with ARCHICAD for home garden- interior garden designing- it parks- corporates- theme parks and ecotourism spots-making sample drawing for indoor gardens.
	Tasks and Assignments:

	Each student is required to submit the following: ✓ Submit sample drawing designs for outdoor and indoor gardens using CAD. ✓ Formulate a lab report (with picturized documentation) on 3D drawing tools Survey one popular CAD company using some model questionnaire **Reference:** 1. Christine Wein-Ping Yu, 1987. Computer-aided Design: Application to Conceptual Thinking in Landscape Architecture. Agrobios Publishing Company, Jodhpur. 2. David Byrnes. 2010. Auto CAD 2010 for DUMMIES. Wiley Publishing Inc., UK. 3. Donnie Gladfelter. 2016. Auto CAD 2016 and Auto CAD LT. 2016. Autodesk Official Press, Wiley India. 4. Farin Gerald, E., Josef Hoschek and Myung-Soo Kim. 2002. Handbook of computer aided geometric design. Elsevier, Amsterdam.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	1
CO2	2	2	2	2	2
CO3	2	3	1	1	1
CO4	2	3	3	1	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	Total
Internal	10	10	10	10	40
External	25	25	10	0	60
Total	**35**	**35**	**20**	**10**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL623	Research III (Observation & Data Analysis)	0	-	6	6

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Interpret the data obtained for the research experiment through statistical tools	Analysis

b. Syllabus

Units	**Content**
PI	Recording the results for the parameters and treatments decided and analysing the data through appropriate statistical tools

c. Mapping of Program Outcomes with Course Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	0	3	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	**Total**
Internal	40	40
External	60	60
Total	**100**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL624	Research IV (Interpretation & Dissertation, Viva)	0	-	6	6

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Equip with knowledge of conducting research with a high problem solving research appetite.	Remember

b. Syllabus

Units	**Content**
PI	Writing results and discussion with critical research interpretation from review of literature, compiling the Introduction, review of literature, Materials and methods, results and discussion with proper summery and conclusion in the form of thesis, Presenting the final research hypothesis to the research advisory committee and audience.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	40	40
External	60	60
Total	**100**	**100**

SEMESTER – IV					
Course Code	**Course Name**	**L**	**T**	**P**	**Credits**
HFL625	Comprehensive Exam Qualifying Viva (Non-Credit Compulsory)	-	-	-	-

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	**Level**
CO1	Acquire overall knowledge of the program by assessment	Understand

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	3	1	0	0	0

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

d. Evaluation Scheme

	CO1	Total
Internal	0	0
External	0	0
Total	**0**	**As satisfactory**

End Semester Question Paper pattern

CENTRAL UNIVERSITY OF TAMIL NADU
EXAMINATION FOR THE DEGREE OF
MASTER OF SCIENCE (HORTICULTURE)
ACADEMIC SESSION 2020-21
INTERANAL EXAMINATION

Course code–Course Name
Month Year | TIME: …. HOURS | TOTAL MARKS: 60

INSTRUCTIONS TO CANDIDATES

1. This paper has TWO (2) parts:

   Part A: One best answer (OBA) (5 questions)
   Fill in the blanks (5 questions)
   Or
   Match the following (5 questions)
   Part B: Descriptive (5 questions)
   Essay (4 questions – Either or Type)

   State your matric number clearly on each answer script.

2. The candidates must answer any **FIVE** questions in **Part B descriptive** and FOUR questions in Essay type (Either or Type)

3. Each question in **Part A** carries 1 (ONE) mark and **Part B** carries 2 (TWO) marks for Descriptive type;10 (TEN) marks for Essay type.

4. While answering **Part B** questions, **draw neatly labelled diagrams** wherever appropriate.

5. The scanned copy of the answer script must be mailed as per the instruction to course teacher immediately after the completion of examination

Registration No.: ……..

(This question paper consists of **20 questions**)

QUESTION PAPER

Time: 2.5 hour Maximum Marks: 60

PART – A
OBJECTIVE (10 x 1 = 10 MARKS)

No. of Questions : 10 (Question No.1 to 10)

Nature of Questions

One Best Answer (with four options) (Q.No. 01 to 05) 5 x 1 Marks = 5

1				
	a)	b)	c)	d)
2				
	a)	b)	c)	d)
3				
	a	b	c)	d)
4				
	a)	b)	c	d)
5				
	a)	b)	c)	d)

Fill in the blanks (Q.No. 06 to 10) 5 x 1 Marks = 5

6	
7	
8	
9	
10	

Or

Match the following

PART – B

DESCRIPTIVE TYPE(5 x 2 = 10 Marks)

No. of Questions : 6

No. of Questions to be answered : 5

Nature of Questions : Brief answer

11	
12	
13	
14	
15	
16	

ESSAY TYPE (4 x 10 = 40 Marks)

No. of Questions : 2 (Either or type)

Nature of Questions : Detail answer in paragraph / 1 page

17	
	or
18	
	or
19	
	or
20	
	or