B. Sc. (Hons.) Horticulture

SYLLABUS
After Implementation of ICAR-FIFTH DEANS' COMMITTEE REPORT

SEMESTERWISE COURSES

Semester – I

Sl. No.	Course Code	Title of the Course	Credit Hours	Off. Dept.	Asso. Dept.
1	**AST 101**	Elementary Statistics	2(1+1)	**AST**	
2	**SSC 102**	Fundamentals of Soil Science	3(2+1)	**SSAC**	
3	**ECO 102**	Fundamentals of Economics and Marketing	3(2+1)	**ECO**	
4	**PPT 102**	Plant Propagation and Nursery Management	2(1+1)	**PPHT**	
5	**SST 101**	Introductory Crop Physiology	2(1+1)	**SST**	
6	**PPT 101**	Fundamentals of Horticulture[#]	2(1+1)	**PPHT**	VSC
7	**FAM 101**	Principles of Landscape Architecture	1(0+1)	**FMAP**	
8	**GPB 102**	Principles of Genetics and Cytogenetics	3(2+1)	**GPB**	
9	**EXT 102**	Communication Skills and Personality Development[#]	2(1+1)	**EXT**	
10	**AST 102**	Elementary Mathematics[#]	2(2+0)*	**AST**	
11	**EXT 103**	Human Values and Ethics[#]	1(1+0)**	**EXT**	
12	**EXT 104**	National Service Scheme/Physical Education & Yoga Practices[#]	2(0+2)**	**EXT**	
		Total	**20 (11+9)+ 2(2+0)*+ 3 (1+3)****		

**R-Remedial Course, **NC- Nongradial courses; # Common course for Ag. And Hort.*

Semester – II

Sl. No.	Course Code	Title of the Course	Credit Hours	Off. Dept.	Asso. Dept.
1	**VSC 151**	Tropical and Subtropical Vegetables	3(2+1)	**VSC**	
2	**GPB 151**	Fundamentals of Plant Breeding[#]	3(2+1)	**GPB**	
3	**SSC 152**	Soil Fertility and Nutrient Management	2(1+1)	**ACSS**	
4	**ENT 152**	Fundamentals of Entomology	3(2+1)	**ENT**	
5	**EXT 152**	Fundamentals of Extension Education	2 (1+1)	**EXT**	
6	**BCH 151**	Fundamentals of Plant Biochemistry[#]	3(2+1)	**BCH**	
7	**PPT 151**	Orchard and Estate Management	2(1+1)	**PPHT**	
8	**PCP 151**	Growth and Development of Horticultural Crops	2(1+1)	**PCP**	PPHT
9	**SSC 153**	Introductory Microbiology	2(1+1)	**SSAC**	
10	**PPT 152**	Dryland Horticulture	2(1+1)	**PPHT**	
		Total	**24 (14+10)**		

Semester – III

Sl. No.	Course Code	Title of the Course	Credit Hours	Off. Dept.	Asso. Dept.
1	**PPA 202**	Fundamentals of Plant Pathology	3(2+1)	**PPA**	
2	**VSC 201**	Spices and Condiments	3(2+1)	**VSC**	
3	**VSC 202**	Organic Farming	3 (2+1)	**VSC**	AGR
4	**ENT 201**	Nematode Pests of Horticultural Crops and their Management	2(1+1)	**ENT**	
5	**GPB 202**	Principles of Plant Biotechnology	2(1+1)	**GPB**	
6	**PPT 201**	Temperate Fruit Crops	2(1+1)	**PPHT**	
7	**FAM 201**	Commercial Floriculture	3(2+1)	**FMAP**	
8	**FOR 201**	Environmental Studies and Disaster Management[#]	3(2+1)	**FOR**	SSAC
9	**AST 201**	Agri- Informatics and Computer Application[#]	2(1+1)	**AST**	
		Total	**23 (14+9)**		

Semester – IV

Sl. No.	Course Code	Title of the Course	Credit Hours	Off. Dept.	Asso. Dept.
1	**SSC 252**	Soil, Water and Plant Analysis	2(1+1)	**SSAC**	
2	**PCP 251**	Weed Management of Horticultural Crops	2(1+1)	**PCP**	VSC, AGR
3	**PPT 251**	Tropical and Subtropical Fruits	4(3+1)	**PPHT**	
4	**FAM 251**	Ornamental Horticulture	3(2+1)	**FMAP**	
5	**PCP 252**	Plantation Crops	3(2+1)	**PCP**	
6	**AEN 251**	Farm Machinery and Power	2(1+1)	**F/ Tech**	
7	**PPA 251**	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	3(2+1)	**PPA**	
8	**ENT 251**	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	3(2+1)	**ENT**	
9	**AGR 254**	Introductory Agro-meteorology & Climate Change[#]	2(1+1)	**AGR**	SSAC
		Total	**24 (15+9)**		

Semester – V

Sl. No.	Course Code	Title of the Course	Credit Hours	Off. Dept.	Asso. Dept.
1	**VSC 301**	Temperate Vegetable Crops	2(1+1)	**VSC**	
2	**AGR 304**	Introduction to Major Field Crops	2 (1+1)	**AGR**	
3	**FAM301**	Medicinal and Aromatic crops	3 (2+1)	**FMAP**	
4	**VSC 303**	Seed Production of Vegetable, Tuber and Spice Crops	3(2+1)	**VSC**	SST
5	**VSC 302**	Breeding of Vegetable, Tuber and Spice Crops	3 (2+1)	**VSC**	GPB
6	**PPA 302**	Diseases of Vegetables, Ornamentals and Spice Crops	3 (2+1)	**PPA**	
7	**PPT 301**	Postharvest Management of Horticultural Crops	3(2+1)	**PPHT**	
8	**EXT 302**	Entrepreneurship Development and Business Management	2(1+1)	**EXT**	
9	**PCP 301**	Processing of Horticultural Crops	3(1+2)	**PCP**	PPHT, F/Tech
		Total	**24 (14+10)**		

Semester – VI

Sl. No.	Course Code	Title of the Course	Credit Hours	Off. Dept.	Asso. Dept.
1	**ENT 352**	Insect Pests of Vegetable, Ornamental and Spice Crops	3(2+1)	**ENT**	
2	**ENT 353**	Apiculture, Sericulture and Lac culture	2(1+1)	**ENT**	
3	**VSC 351**	Precision Farming and Protected Cultivation	3(2+1)	**VSC**	**F/Tech, FMAP**
4	**FOR 351**	Introductory Agroforestry	2 (1+1)	**FOR**	
5	**FAM 351**	Breeding and Seed Production of Flower and Ornamental Plants	3(2+1)	**FMAP**	**SST**
6	**PCP 351**	Water Management in Horticultural Crops	2(1+1)	**PCP**	**VSC,AGR ,F/Tech**
7	**ECO 352**	Horti-Business Management	3(2+1)	**ECO**	
8	**VSC 352**	Potato and Tuber Crops	2 (1+1)	**VSC**	
9	**PPT 351**	Breeding of Fruit and Plantation Crops	3(2+1)	**PPHT**	**PCP**
10	**PPT 352**	Principles of Food Science and Nutrition[#]	2(2+0)	**PPHT**	
		Total	**25 (16+9)**		

Semester – VII and VIII

Student READY
(Rural Entrepreneurship Awareness and Development Yojana)
programme will be taken up during VII and VIII semesters
w.e.f. Academic Session 2016-2017
and will have the following components.

Semester - VII

Student READY- Rural Horticulture Work Experience (RHWE): Placement in Villages & Placement in Industries:

This program will be taken up during the VII semester for a duration of 24 weeks and will be allotted 0+20 credit hours. The program will include orientation, village stay, all India study tour, industrial placement program, report writing and final examination.

Sl. No.	Course Code	Title of the Course	Credit Hours
1	**SR 401**	Student READY- Placement in Villages	0+10
2	**SR 402**	Student READY - Placement in Industries	0+10
		Total	**20 (0+20)**

Sl. No.	RHWE Programme schedule	Duration
1	Orientation Programme	2 weeks
2	Village stay	12 weeks
3	All India Study Tour (if not completed in earlier semesters)	3 weeks
4	Industrial Placement Programme	4 weeks
5	Report writing & Final Examination	3 weeks
Total		**24 Weeks**

Semester –VIII

Student READY: Experiential Learning Programmes (Professional Package) will be for the duration of 20 weeks and will carry a weightage of 0+20 credit hours. Students can select any two modules from the following under **Student READY-Experiential Learning programmes** depending on the facilities available at the Faculty:

Sl. No.	Course Code	Title of the Course (any two)	Credit Hours
Student READY: Experimental Learning programmes			**20 (0+20)**
1	**SR 451**	Module 1	**10 (0+10)**
2	**SR 452**	Module 2	**10 (0+10)**
		Total	**20 (0+20)**

Sl. No.	Title of the Course (any two)	Credit Hours
Student READY: Experimental Learning programmes		**20 (0+20)**
1	Commercial Horticulture	**10 (0+10)**
2	Protective Cultivation of High Value Horticulture Crops	**10 (0+10)**
3.	Mass Multiplication of Plant And Molecules through Tissue Culture	**10 (0+10)**

Total Credit Hours Distribution in different Semesters

Semester No.	Normal Courses	Remedial Courses	Nongradial Courses
First	20(11+9)	2(2+0)*	3(1+2)**
Second	24 (14+10)		
Third	23 (14+9)		
Forth	24 (15+9)		
Fifth	24(14+10)		
Sixth	25(16+9) =140(84+56)		
Seventh	20(0+20)		
Eighth	20(0+20)		
Total	180(84+96)	2(2+0)*	3(1+2)**
			185 (87+98)
	Total Credit Hours		**185**

DEPARTMENTWISE/DISCIPLINEWISE COURSES

1. Pomology and Post Harvest Technology (PPHT)

Course Code	Course title	Credit hours	Semester
PPT 101	Fundamentals of Horticulture	2(1+1)	**I**
PPT 102	Plant Propagation and Nursery Management	2(1+1)	**I**
PPT 151	Orchard and Estate Management	2(1+1)	**II**
PPT 152	Dryland Horticulture	2(1+1)	**II**
PPT 201	Temperate Fruit Crops	2(1+1)	**III**
PPT 251	Tropical and Subtropical Fruits	4(3+1)	**IV**
PPT 301	Postharvest Management of Horticultural Crops	3(2+1)	**V**
PPT 351	Breeding of Fruit and Plantation Crops	3(2+1)	**VI**
PPT 352	Principles of Food Science and Nutrition	2(2+0)	**VI**
	Total	**22 (13+9)**	

2. Vegetable and Spice Crops (VSC)

Course Code	Course title	Credit hours	Semester
VSC 151	Tropical and Subtropical Vegetable crops	3(2+1)	**II**
VSC 201	Spices and Condiments	3(2+1)	**III**
VSC 202	Organic Farming	3(2+1)	**III**
VSC 301	Temperate Vegetable crops	2(1+1)	**V**
VSC 302	Breeding of Vegetable Tuber and Spice Crops	3(2+1)	**V**
VSC 303	Seed Production of Vegetable Tuber and Spice Crops	3(2+1)	**V**
VSC 352	Potato and Tuber Crops	2(1+1)	**VI**
VSC 351	Precision Farming and Protected Cultivation	3(2+1)	**VI**
	Total	**22 (14+8)**	

3. Floriculture, Medicinal and Aromatic Plants (FMAP)

Course Code	Course title	Credit hours	Semester
FAM 101	Principles of Landscape Architecture	1(0+1)	**I**
FAM 201	Commercial Floriculture	3(2+1)	**III**
FAM 251	Ornamental Horticulture	3(2+1)	**IV**
FAM 301	Medicinal and Aromatic Crops	3(2+1)	**V**
FAM 351	Breeding and Seed Production of Flower and Ornamental Crops	3(2+1)	**VI**
	Total	**13(8+5)**	

4. Plantation Crops and Processing(PCP)

Course Code	Course title	Credit hours	Semester
PCP 151	Growth and Development of Horticultural Crops	2(1+1)	**II**
PCP 251	Weed Management in Horticultural Crops	2(1+1)	**IV**
PCP 252	Plantation Crops	3(2+1)	**IV**
PCP 301	Processing of Horticultural Crops	3(1+2)	**V**
PCP 351	Water Management in Horticultural Crops	2(1+1)	**VI**
	Total	**12(6+6)**	

5. Forestry(FOR)

Course Code	Course title	Credit hours	Semester
FOR 201	Environmental Studies and Disaster Management[#]	3(2+1)	**III**
FOR 351	Introductory Agroforestry	2(1+1)	**VI**
	Total	**5(3+2)**	

6. Agronomy(AGR)

Course Code	Course title	Credit hours	Semester
AGR 254	Introductory Agro-meteorology & Climate Change[#]	2(1+1)	**IV**
AGR 304	Introduction to Major Field Crops	2 (1+1)	**V**
	Total	**4(2+2)**	

7. Soil Science and Agril. Chemistry (SSC)

Course Code	Course title	Credit hours	Semester
SSC 102	Fundamental of Soil Science	3(2+1)	**I**
SSC 152	Soil Fertility and Nutrient Management	2(1+1)	**II**
SSC 153	Introductory Microbiology[#]	2(1+1)	**II**
SSC 252	Soil, Water and Plant Analysis	2(1+1)	**IV**
	Total	**9(5+4)**	

8. Genetics and Plant Breeding(GPB)

Course Code	Course title	Credit hours	Semester
GPB 102	Principles of Genetics and Cytogenetics	3(2+1)	**I**
GPB 151	Principles of Plant Breeding	3(2+1)	**II**
GPB 202	Fundamentals of Plant Biotechnology[#]	2(1+1)	**III**
	Total	**8(5+3)**	

9. Seed Science and Technology(SST)

Course Code	Course title	Credit hours	Semester
SST 101	Introductory Crop Physiology	2(1+1)	**I**
	Total	**2(1+1)**	

10. Agricultural Entomology(ENT)

Course Code	Course title	Credit hours	Semester
ENT 152	Fundamentals of Entomology	3(2+1)	**II**
ENT 201	Nematode pests of horticultural crops and their Management	2(1+1)	**III**
ENT 251	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	3(2+1)	**IV**
ENT 352	Insect Pests of Vegetable, Ornamental and Spice Crops	3(2+1)	**VI**
ENT 353	Apiculture, Sericulture and Lac culture	2(1+1)	**VI**
	Total	**13(8+5)**	

11. Plant Pathology(PPA)

Course Code	Course title	Credit hours	Semester
PPA 202	Fundamentals of Plant Pathology	3(2+1)	**III**
PPA 251	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	3(2+1)	**IV**
PPA 302	Diseases of Vegetables, Ornamentals and Spice Crops	3 (2+1)	**V**
	Total	**9(6+3)**	

12. Agricultural Extension(EXT)

Course Code	Course title	Credit hours	Semester
EXT 102	Communication Skills and Personality Development[#]	2(1+1)	**I**
EXT 103	Human Values and Ethics[#]	1(1+0)**	**I**
EXT 104	National Service Scheme/Physical Education & Yoga Practices[#]	2(0+2)**	**I**
EXT 152	Fundamentals of Extension Education	2 (1+1)	**II**
EXT 302	Entrepreneurship Development and Business Management	2(1+1)	**V**
	Total	**8(4+4)**	

13.Agricultural Economics(ECO)

Course Code	Course title	Credit hours	Semester
ECO 102	Fundamentals of Economics and Marketing	3(2+1)	**I**
ECO 352	Horti-Business Management	3(2+1)**	**VI**
	Total	**6(4+2)**	

14. Agricultural Statistics (AST)

Course Code	Course title	Credit hours	Semester
AST 101	Elementary Statistics	2(1+1)	**I**
AST 102	Elementary Mathematics[#]	2(2+0)*	**I**
AST 201	Agri- Informatics and Computer Application[#]	2(1+1)	**III**
	Total	**6(4+2)**	

15. Biochemistry(BCH)

Course Code	Course title	Credit hours	Semester
BCH 151	Fundamentals of Plant Biochemistry#	3(2+1)	**II**
	Total	**3(2+1)**	

16. Agricultural Engineering(AE)/Faculty of Technology

Course Code	Course title	Credit hours	Semester
AEN 251	Farm Machinery and Power	2(1+1)	**IV**
	Total	**2(1+1)**	

DEPARTMENTWISE / DISCIPLINEWISE DETAILED SYLLABUS

1. Pomology and Post Harvest Technology(PPHT)

Course Code	Course title	Credit hours	Semester
PPT 101	Fundamentals of Horticulture	2(1+1)	**I**
PPT 102	Plant Propagation and Nursery Management	2(1+1)	**I**
PPT 151	Orchard and Estate Management	2(1+1)	**II**
PPT 152	Dryland Horticulture	2(1+1)	**II**
PPT 201	Temperate Fruit Crops	2(1+1)	**III**
PPT 251	Tropical and Subtropical Fruits	4(3+1)	**IV**
PPT 301	Postharvest Management of Horticultural Crops	3(2+1)	**V**
PPT 351	Breeding of Fruit and Plantation Crops	3(2+1)	**VI**
PPT 352	Principles of Food Science and Nutrition	2(2+0)	**VI**
	Total	**22 (13+9)**	

PPT 101: Fundamentals of Horticulture 2 (1+1)

Theory

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; area & production, exports and imports, fruit and vegetable zones, Types of vegetable garden, Classification of bearing habits of fruit tree, climate and soil for horticultural crops, Basic concepts of plant propagation, principles of orchard establishment; Principles and methods of training and pruning, importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation. Layout and planting systems of orchard.

Training and pruning of fruit trees. Preparation of potting mixture, preparation of fertilizer mixtures and Fertilizer application in different crops. Preparation and application of growth regulators, Assessment of bearing habits.

PPT 102: Plant Propagation and Nursery Management 2(1+1)

Theory

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy types of dormancy (scarification & stratification) internal and external factors. Nursery techniques nursery management. Apomixes – mono-embrony, polyembrony, chimera& bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery (tools and implements). Use of growth regulators. Types of seeds, stages of seed germination. Vegetative propagation: cutting, layering, budding, grafting. formation of graft union, factor affecting, healing of graftage and budding. Physiological & bio chemical basis of rooting. Factors influencing rooting of cuttings and layering. Graft incompatibility. Anatomical studies of bud union. Selection and maintenance of mother trees. Collection of scion wood stick. Scion-stock relationship, and their influences. Bud wood certification. Techniques of propagation through specialized organs: corm, runners, suckers, division, stolons, pseudobulbs, offsets etc. Micrografting, Meristem culture, Callus culture, Anther culture, Organogenesis, Somaclonal variation. Hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery, Cost of establishment of propagation structures. Top working, frame working.

Practical

Media for propagation of plants in nursery beds. Preparation of plant material for potting & potting and repotting. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Hardening plants in the nursery. Practicing different types of cuttings, layering, graftings and buddings. Use of mist chamber in propagation. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging,

labeling and packing of nursery fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their maintenance. Nutrient and plant protection applications during nursery.

PPT 151: Orchard and Estate Management 2(1+1)

Theory

Orchard & estate management, importance, objectives, merits and demerits. Clean cultivation, Sod culture, Sod mulch. Weed management, herbicides. Inorganic and organic mulches & its merits, demerits. Cropping Systems: Intercropping, Multitier cropping, Green manuring & its merits, demerits Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems. Systems of irrigation. Soil management in relation to nutrient and water uptake. Factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards. Fertility management in horticultural crops. Manures and fertilizers. Integrated nutrient and pest management. Principles of organic farming. Crop model and crop regulation. Climate aberrations and mitigation measures of Horticultural crops.

Practical

Layout of different systems of orchard and estate, soil management, clean, inter, cover and mixed cropping, fillers. Use of mulch materials, organic and inorganic, moisture conservation, weed control. Layout of various irrigation systems.

PPT 152: Dry land Horticulture 2(1+1)

Theory

Definition, importance and limitation of dry land horticulture, present status and future scope. Constraints encounter in dry lands. Agro-climatic features in arid, semi arid areas. Techniques and management of dry land horticulture. Watershed development. Soil and water conservation methods-terraces, contour bunds, etc.

Methods of control and impounding of run-off water-farm ponds, trenches, macro catch pits, etc. *In-situ* water harvesting methods, micro catchment, different types of tree basins etc. Methods of reducing evapotranspiration, Use of shelter belts, mulches, antitranspirants, growth regulators, etc. Water use efficiency-need based, economic and conjunctive use of water, Micro systems of irrigation etc. Selection of plants having drought resistance. Special techniques, planting and after care-use of seedling races, root stocks, *in-situ* grafting, deep pitting/planting, canopy management etc. Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.

Practical

Mapping of arid and semi-arid zones. Study of rainfall patterns. Contour bunding / trenching, Micro catchments, Soil erosion and its control. Study of evapotranspiration, mulches and micro irrigation systems. Special techniques of planting and aftercare in dry lands. Study of morphological and anatomical features of drought tolerant fruit crops.

PPT 201: Temperate Fruit Crops 2 (1+1)

Theory

Classification of temperate fruits, detailed study of areas, production, varieties, climate and soil requirements, propagation, planting density, cropping systems, after care training and pruning, self-incompatibility and pollinisers, use of growth regulators, nutrient and weed management, harvesting, post-harvest handling and storage of apple, pear, peach, apricot, plum, cherry, persimmon, strawberry, kiwi, Queens land nut (Mecademia nut), almond, walnut, pecan nut, hazel nut and chest nut. Re-plant problem, rejuvenation and special production problems like pre-mature leaf fall, physiological disorders, important insect – pests and diseases and their control measures. Special production problems like alternate bearing problem and their remedies.

Practical

Nursery management practices, description and identification of varieties of above crops, manuring and fertilization, planting systems, preparation and use of growth regulators, training and pruning in apple, pear, plum, peach and nut crops. Visit to private orchards to diagnose maladies. Working out economics for apple, pear, plum and peach.

PPT 251: Tropical and Sub-Tropical Fruits 4 (3+1)

Theory

Horticultural classification of fruits including genome classification. Horticultural zones of India, detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, , banana, grapes,
citrus, papaya, sapota, guava, pomegranate, bael, ber, amla, anona, fig, pineapple, jackfruit, avocado, mangos teen, litchi, carambola, durian, rambutan, bilimbi, loquat, rose apple breadfruit and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and casual factors and their management. Bud forecasting in grapes, sex expression and seed production in papaya, latex extraction and crude papain production, economic of production.

Practical

Description and identification of varieties of tropical & sub-tropical fruit crops. Training and pruning of different tropical & sub-tropical fruit crops. Selection of site and planting system. Pre-treatment of banana suckers, desuckering in banana, Sex forms in papaya. Use of

plastics in fruit production. Visit to commercial orchards and diagnosis of maladies. Manure and fertilizer application including bio-fertilizer in fruit crops. Preparation and application of growth regulators in different tropical & sub-tropical fruit crops. Seed production in papaya, Latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging. Production economics for tropical and sub-tropical fruits. Botanical description and identification of different tropical & sub-tropical fruit crops.

PPT 252: Breeding of Fruit and Plantation Crops 3 (2+1)

Theory

Fruit breeding - History, importance in fruit production. Distribution, domestication and adaptation of commercially important fruits, variability for economic traits. Breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement. *in vitro* breeding tools . Breeding methods and achievements of some important fruit and plantation crops like Mango, Banana, Citrus, Grapes, Guava, Sapota, Papaya, Aonla, Litchi, Pomegranate, Arecanut, Coconut, Cashewnut, Cocoa, Tea, Coffee, Rubber, Betel vine

Practical

Exercises on floral biology, pollen viability; emasculation and pollination procedures; hybrid seed germination; raising and evaluation of segregating populations; use of mutagens to induce mutations and polyploidy in major crops like Mango, Banana, Citrus, Grapes, Guava, Sapota, Papaya, Custard apple, Aonla, Ber, Litchi, Pomegranate, Jamun, Arecanut, Coconut, Pistchonut, Apple, Pear, Plum, Peach, Apricut and Strawberry.

PPT301: Postharvest Management of Horticultural Crops 3(2+1)

Theory

Importance of Postharvest Technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, spices, medicinal and aromatic plants. Pre-harvest factors affecting quality, factors responsible for deterioration of

horticultural produce, physiological and bio-chemical changes, Hastening and delaying ripening process. Postharvest treatments of horticultural crops. Quality parameters and specifications. Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. Methods of storage for local market and export. Pre-harvest treatment and pre-cooling, pre-storage treatments. Different systems of storage, packaging methods and types of packages, recent advances in packaging. Types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments. Modes of transport. **Market chain management**

Practical

Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality. Grading of horticultural produce, post-harvest treatment of horticultural crops, physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops, spices and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce. Identification of storage pests and diseases in spices. Visit to markets, packing houses and cold storage units.

PPT 351: Principles of Food Science and Nutrition 2(2+0)

Theory

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions); Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

2. Vegetable and Spice Crops (VSC)

Course Code	Course title	Credit hours	Semester
VSC 151	Tropical and Subtropical Vegetable Crops	3(2+1)	**II**
VSC 201	Spices and Condiments	3(2+1)	**III**
VSC 202	Organic Farming	3(2+1)	**III**
VSC 301	Temperate Vegetable crops	2(1+1)	**V**
VSC 302	Breeding of Vegetable Tuber and Spice Crops	3(2+1)	**V**
VSC 303	Seed Production of Vegetable Tuber and Spice Crops	3(2+1)	**V**
VSC 352	Potato and Tuber Crops	2(1+1)	**VI**
VSC 351	Precision Farming and Protected Cultivation	3(2+1)	**VI**
	Total	**22 (14+8)**	

VSC 151: Tropical and Sub-tropical Vegetable Crops

3 (2+1)

Theory

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield, post-harvest handling, economics and marketing of tropical and sub-tropical vegetable crops such as tomato, brinjal, chillies, capsicum, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca, basella, sorrel and roselle.

Practical

Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and

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

VSC 201: Spices and Condiments 3(2+1)

Theory

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

Practical

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

VSC 202: Organic Farming 3(2+1)

Theory

Introduction, concept, relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manures, vermicomposting, green manuring, recycling of organic residues, biofertilizers; Soil improvement and amendments; Integrated diseases and pest management – use of biocontrol agents, biopesticides pheromones, trap crops, bird perches; Weed management; Quality considerations, certification, labeling and accreditation processors, marketing, exports.

Practical

Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, postharvest management.

VSC 301:Temperate Vegetable Crops 2(1+1)

Theory

Importance of cool season vegetable crops in nutrition and national economy. Area, production, export potential, description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of cabbage, cauliflower, knol-khol, sprouting broccoli, Brussels' sprout, lettuce, palak, Chinese cabbage, spinach, garlic, onion, leek, radish, carrot, turnip, beet root, peas, broad beans, rhubarb, asparagus, globe artichoke, Vegetable kale.

Practical

Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting; identification of physiological and nutritional disorders and their corrections; post-harvest handling; cost of cultivation and field visits to commercial farms.

VSC 302: Breeding of Vegetable, Tuber and Spice Crops 3(2+1)

Theory

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops. Plant genetic resources, their conservation and utilization in crop improvement. Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, male sterility and incompatibility and their utilization in development of hybrids. Origin, distribution of species, wild relatives and forms of vegetable crops Tomato, Brinjal, Bhendi, Capsicum, Chilli, Cucurbits, Cabbage, Cauliflower, Tuber crops, Potato, Carrot, Radish, Spice crops (Ginger, Turmeric).Breeding procedures for development of hybrids/varieties in various crops. Genetic basis of adoptability and stability.

Practical

Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance. GCA, SCA, combining ability, heterosis, heterobeltosis, standard heterosis, GxE interactions (stability analysis) Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

VSC 303 : Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

Theory

Introduction and history of seed industry in India. Definition of seed, classes-types of seed. Differences between grain and seed. Importance and scope of vegetable seed production in India. Principles of vegetable seed production. Role of temperature, humidity

and light in vegetable seed production, land requirements, climate, season, planting time, nursery management, seed rate, rouging, seed extraction and storage of cole crops, root vegetables, solanaceous vegetables, cucurbits, okra, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables. Seed germination and purity analysis. Field and seed standards. Seed drying and extraction. Seed legislation.

Practical

Study of seed structure, colour size, shape and texture. Field inspection of seed crops. Practices in rouging. Harvesting and seed extraction. Germination and purity analysis. Methods of seed production, Seed certification in cole crops, root vegetables, bulb crops, solanaceous vegetables, cucurbits, okra, leafy vegetables, leguminous vegetables and exotic vegetables. Seed processing machines. Visit to seed production units.

VSC 352: Potato and Tuber Crops 2 (1+1)

Theory

Origin, area, production, economic importance and export potential of potato and tropical, sub-tropical and temperate tuber crops; description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems. Harvesting practices, yield; economic of cultivation. Post- harvest handling and storage, field and seed standards, marketing. Crops to be covered – potato, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, Jerusalem artichoke, horse radish and other under exploited tuber crops.

Practical

Identification and description of potato and tropical, sub-tropical and temperate tuber crops; planting systems and practices; field preparation and sowing/planting. Top dressing of fertilizers and interculture and use of herbicides and growth regulators; identification of nutrient deficiencies, physiological disorders; harvest indices and maturity standards, post-harvest handling and storage, marketing. Seed collection, working out cost of cultivation, project preparation of commercial cultivation.

VSC 351
Precision Farming & Protected Cultivation 3 (2+1)

Theory

Precision farming – laser leveling, mechanized direct seed sowing; seedling and sapling transplanting, mapping of soils and plant attributes, site specific input application, weed management, insect pests and disease management, yield mapping in horticultural crops. Green house technology, Introduction, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes. Green house equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, Typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies. Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics.

Practical

Study of different types of greenhouses based on shape, construction and cladding materials; Calculation of air rate exchange in an active summer winter cooling system; Calculation of rate of air exchange in an active winter cooling system; Estimation of drying rate of agricultural products inside green house; Testing of soil and water to study its suitability for growing crops in greenhouses; The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization; Visit to commercial green houses; Economics of protected cultivation.

3. Floriculture, Medicinal and Aromatic Plants (FMAP)

Course Code	Course title	Credit hours	Semester
FAM 101	Principles of Landscape Architecture	1(0+1)	**I**
FAM 201	Commercial Floriculture	3(2+1)	**III**
FAM 251	Ornamental Horticulture	3(2+1)	**IV**
FAM 301	Medicinal and Aromatic Crops	3(2+1)	**V**
FAM 351	Breeding and Seed Production of Flower and Ornamental Crops	3(2+1)	**VI**
	Total	**13 (8+5)**	

FAM 101: Principles of Landscape Architecture 2(1 +1)

Theory

Historical Importance of Indian gardens, Gardens of ancient world, Definitions, Famous gardens of India and abroad, formal, informal, free style and wild gardens, basic themes of gardens viz. circular, rectangular and diagonal themes, Steps in preparation of garden design. Use of Auto CAD and Arch CAD in designing gardens. Factors affecting landscape design viz. intial approach, view, human choice, simplicity, topography etc., Principles of Landscape gardens viz. Axis, rhythm, balance, time and light, space, texture, form, mass effect, focal point, mobility, emphasis, unity and harmony etc.. Elements of landscape gardens viz. tangible and intangible elements. Bio-aesthetic planning, definition, objectives, Planning and designing of home gardens, colonies, country planning, urban landscape, Development of institutional gardens, planning and planting of avenues, beautifying schools, railway lines, railway stations, factories, bus stands, air ports corporate buildings, dams, hydro electric stations, river banks, play grounds, Gardens for places of religious importance viz. temples, churches, mosques, tombs etc, Importance, features and establishment of English garden , Japanese gardens , Mughal, gardens, French and Persian garden, Italian gardens, Hindu gardens and Buddhist gardens, Xeriscaping, definition, principles and practice.

Practical

Study of garden equipments. Study of Graphic language, Use of drawing equipments, graphic symbols and notations in landscaping designing, Study and designing of different styles of gardens, Study and designing of gardens based on different themes, Designing gardens using Auto-cad/ archi-cad, Designing gardens for home, traffic islands, schools and colleges, public buildings, factories, railway stations, air ports, temples, churches, play grounds, corporate buildings/ malls. Designing and planting of avenues for state and National highways, Design and establishment of Japanese, English and Mughal gardens. Visit to public, institutional and botanical gardens.

FAM 201: Commercial Floriculture 3 (2+1)

Theory

Scope and importance of commercial floriculture in India, production techniques of commercial flower crops like rose, marigold, chrysanthemum, orchid, carnation, gladiolus, jasmine, crossandra, anthurium, dahlia, tuberose, bird of paradise, china aster and gerbera for domestic and export market, production techniques of flowers and foliage filler materials growing of flowers under protected environments such as glass house, plastic house etc., postharvest technology of cut flowers in respect of commercial flower crops, dehydration technique for drying of flowers, production techniques for bulbous.

Practical

Identification of commercially important floricultural crops. Propagation practices in chrysanthemum, sowing of seeds and raising of seedlings of annuals. Propagation by cutting, layering, budding and grafting. Training and pruning of roses. Use of chemicals and other compounds for prolonging the vase life of cut flowers. Drying and preservation of flowers. Flower arrangement practices.

FAM 251: Ornamental Horticulture 2(1+1)

Theory

History, definitions, scope of ornamental horticulture, aesthetic values, Floriculture industry, Importance, area and production, industrial importance of ornamental plants and flowers. Importance, classification, design values and general cultivation aspects for ornamental plants *viz*. Annuals, biennales herbaceous perennials, grasses and bulbous ornamentals. shrubs, climbers, trees, indoor plants, palms and cycads, ferns and sellagenellas, cacti and succulents, Importance, design and establishment of garden features/components viz. hedge, edge, borders, flower beds, bridges, paths, drives, fences, garden walls, gates, carpet bed, arbour, Patio, decking, retaining walls, shade garden, sunken garden, roof garden, terrace garden, pebble garden, rockery, pools, waterfalls, fountains, bog garden, avenue planting and children garden. Lawn types, establishment and maintenance. Importance of Garden adornments viz. floral clock, bird bath, statutes, sculptures, lanterns, water basins, garden benches etc.. Importance of flower arrangement, Ikebana, techniques, types, suitable flowers and cut foliage, uses of vertical garden, bottle garden, terrariums, art of making bonsai, culture of bonsai and maintenance.

Practical

Identification and description of annuals, biennials, herbaceous perennials, climbers, shrubs, trees, indoor plants, ferns and sellagenellas, Palms and cycads and Cacti and succulents. Planning and designing and establishment of garden features viz. lawn, hedge and edge, rockery, water garden, carpet bedding, shade garden, roof garden, Study and creation of terrariums, vertical garden, study and practice of different types of flower arrangements, preparation of floral bouquets, preparation of floral rangoli, veni etc., Study of Bonsai techniques, Bonsai practicing and training. Visit to nurseries and floriculture units.

FAM 301: Medicinal and Aromatic Crops 3(2+1)

Theory

History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural practices, training and pruning, nutritional and water requirements. Plant protection, harvesting and processing of under mentioned important medicinal and aromatic plants. Study of chemical composition of a few important medicinal and aromatic plants, extraction, use and economics of drugs and essential oils in medicinal and aromatic plants. Therapeutic and pharmaceutical uses of important species. Storage techniques of essential oils. Medicinal Plants: *Withania*, periwinkle, Rauvolfia, Dioscorea, Isabgol, opium poppy *Ammi majus*, Belladonna, Cinchona, Pyrethrum and other species relevant to local conditions. Aromatic Plants: Citronella grass, khus grass, flag (baje), lavender, geranium, patchouli, bursera, menthe, musk, occimum and other species relevant to the local conditions. Marketing.

Practical

Collection of medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and extraction of essential oils.

FAM 351: Breeding and Seed Production of Flower and Ornamental Crops 3(2+1)

Theory

History of improvements of ornamental plants, Centre of origin of flower crops and ornamental crops, objectives and techniques in ornamental plant breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops *viz*., Rose, Jasmine, Chrysanthemum, Tuberose, Gerbera, Gladiolus, dahlia Heliconia, Lilium, Gaillardia, Petunia, *Hibiscus*, Bouganvillea, Zinnia, Cosmos, Dianthus, Snapdragon, Pansy, crossandra, marigold, , geranium, antirrhinium, china aster, orchids, anthurium, carnation, hibiscus etc. Breeding for disease resistance. Development of promising cultivars of important ornamentals and flower crops. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting processing and storage of seeds, seed certification.

Practical

Study of floral biology and pollination in important species and cultivars. Techniques of inducing polyploidy and mutation. Production of pure and hybrid seeds. Harvesting, conditioning and testing of seeds. Practice in seed production methods.

4. Plantation Crops and Processing(PCP)

Course Code	Course title	Credit hours	Semester
PCP 151	Growth and Development of Horticultural Crops	2(1+1)	**II**
PCP 251	Weed Management in Horticultural Crops	2(1+1)	**IV**
PCP 252	Plantation Crops	3(2+1)	**IV**
PCP 301	Processing of Horticultural Crops	3(1+2)	**V**
PCP 351	Water Management in Horticultural Crops	2(1+1)	**VI**
	Total	**12 (6+6)**	

PCP 151: Growth and Development of Horticultural Crops **2(1+1)**

Theory

Growth and development-definitions, components, photosynthetic productivity, Canopy photosynthesis and productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, Crop development and dynamics (Case studies of annual / perennial horticultural crops),

growth analysis in horticultural crops. Plant bio-regulators- auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering-factors affecting flowering, physiology of flowering, photoperiodism-long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning-source and sink relationship, translocation of assimilates. Physiology of seed

development and maturation, seed dormancy and bud dormancy, Causes and breaking methods in horticultural crops. Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non-climacteric fruits. Physiology of fruits under post-harvest storage.

Practical

Estimation of photosynthetic potential of horticultural crops, leaf area index, growth analysis parameters including harvest index, bioassay of plant hormones, identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, seed dormancy, seed germination and breaking seed dormancy with chemicals and growth regulators.

PCP 251: Weed Management in Horticultural Crops 2 (1+1)

Theory

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

Practical

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

PCP 252: Plantation Crops 3 (2+1)

Theory

History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by products utilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of coconut, arecanut, oil palm, palmyrah palm, cacao, cashew nut, coffee, tea, Date palm and rubber.

Practical

Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cacao gardens, manuring, irrigation; mulching, raising masonry

nursery for palm, nursery management in cacao. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood, grafting and top working in cashew, working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea.

PCP 301: Processing of Horticultural Crops 3(1+2)

Theory

Importance and scope of fruit and vegetable preservation industry in India, Food pipe line, losses in post-harvest operations, Unit operations in food processing. Principles and guidelines for the location of processing units. *Principles and methods of preservation by heat - pasteurization, canning, bottling. *Methods of preparation of juices, squashes, syrups, cordials and fermented beverages. *Jam, jelly and marmalade. Preservation by sugar and chemicals, candies, crystallized fruits, preserves *chemical preservatives, *preservation with salt and vinegar, pickling,*chutneys and sauces, tomato and mushrooms, freezing preservation. Processing of plantation crops, products, Spoilage in processed foods, quality control of processed products, Govt. policy on import and export of processed fruits. Food laws.

Practical

Equipments used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables, preparation of squash, RTS, cordial, syrup, jam, jelly, marmalade, candies, preserves, chutneys, sauces, pickles (hot and sweet).

Dehydration of fruits and vegetables – tomato product dehydration, refrigeration and freezing, cut out analysis of processed foods. Processing of plantation crops. Visit to processing units.

PCP 351: Water Management in Horticultural Crops 2(1+1)

Theory

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

Practical

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

5. Forestry(FOR)

Course Code	Course title	Credit hours	Semester
FOR 201	Environmental Studies and Disaster Management[#]	3(2+1)	**III**
FOR 351	Introductory Agroforestry	2(1+1)	**VI**
	Total	**5 (3+2)**	

FOR 201: Environmental Studies and Disaster Management **3(2+1)**

Theory

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources. Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ecosystems, Concept of an ecosystem. Structure and function of an ecosystem. Producers,

consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem:- a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation:- Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity - habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental Pollution: definition, cause, effects and control measures of - Air, Water, Soil, Marine, Noise and Thermal pollution and Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust dies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air, Water, Wildlife and Forest Conservation Acts, Issues involved in enforcement of environmental legislation and Public awareness. Human Population and the Environment: population growth, variation among nations,

population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc. Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Practical

Visit to local areas - river/forest/ grassland/catchment etc. to document components of ecosystem. Study of common plants, insects, birds and animals. Visit to industries to study pollution abatement techniques and case studies - solid waste management, Human population and the Environment.

FOR 351: Introductory Agro-forestry 2(1+1)

Theory

Agroforestry – definition, objectives and potential. Distinction between agroforestry and social forestry. Status of Indian forests and role in India farming systems. Agroforestry system, sub-system and practice: agri-silviculture, silvipastoral, horti-silviculture, horti-silvipastoral, shifting cultivation, taungya, home gardens, alley cropping, intercropping, wind breaks, shelterbelts and energy plantations. Planning for agroforestry – constraints, diagnosis and design methodology, selection of tree crop species for agro-forestry. Agroforestry projects – national, overseas, MPTS – their management practices, economics of cultivation – nursery and planting (*Acacia catechu*, *Dalbergiasissoo*, Tectona, Populus, Morus, Grewia, Eucalyptus, Quercus spp. and bamboo, tamarind, neem etc.).

Practical

Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, Grewiaoptiva, Morus alba, Acacia catechu, *Dalbergiasissoo*, robinia, leucaena etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops: silvipastoral, alley cropping, horti-silviculture, agro-silvipasture, fuel and fodder blocks. Visit to social forestry plantations – railway line plantations, canal plantations, roadside plantations, industrial plantations and shelterbelts. Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages. Economics and marketing of products raised in agro-forestry systems.

6. Agronomy (AGR)

Course Code	Course title	Credit hours	Semester
AGR 254	Introductory Agro-meteorology & Climate Change[#]	2(1+1)	**IV**
AGR 304	Introduction to Major Field Crops	2 (1+1)	**V**
	Total	**4 (2+2)**	

AGR 254: Agro-meteorology and Climate Change 2(1+1)

Theory

Agricultural Meteorology- Introduction, definition of meteorology, scope and practical utility of Agricultural meteorology. Composition and structure of atmosphere and definition of weather and climate, aspects involved in weather and climate, atmospheric temperature, soil temperature, solar radiation, atmospheric pressure, atmospheric humidity, evaporation and transpiration, monsoons, rainfall, clouds, drought, weather disasters and their management atmospheric pollution and role of meteorology. Basics of weather forecasting. Climate change-causes. Global warming-causes and remote sensing. Effect of climate change on horticulture Past and future changes in greenhouse gases within the atmosphere. Sources and sinks for greenhouse gases. Atmospheric chemistry. Plants sense and respond to changes in CO2 concentration. Measurement of short-term effects and mechanisms underlying the observed responses in C3 and C4 species. plant development affected by growth in elevated CO2. Physiology of rising CO2 on nitrogen use and soil fertility, its implication for production. Methodology for studying effect of CO2. Change in secondary metabolites and pest disease reaction of plants. The mechanisms of ozone and UV damage and tolerance in plants. Increased temperature and plants in tropical/sub-tropical climates-effect on growing season, timing of flowering, duration of fruit development and impacts on crop yields and potential species

ranges, interaction of temperature with other abiotic/biotic stress. Mitigation strategies and prospects for genetic manipulation of crops to maximize production in the future atmosphere. Modifying Rubisco, acclimation, metabolism of oxidizing radicals, and sink capacity as potential strategies.

Practical

Site selection for Agromet observatory; Measurement of temperature; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of atmospheric pressure; Measurement of sunshine duration and solar radiation; Measurement of wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts. Visit to Meteorological observatory, Visit to IMD meteorological observatory-Lay out plan of standard meteorological observatory. Recording of air and soil temperature. Measurement of radiation and components, Measurement of rainfall-different types of raingauges, Measurement of wind speed and direction and atmospheric humidity, Recording of evaporation. Synoptic charts and weather reports, symbols, *etc*.

AGR 304: Introduction to Major Field Crops 2(1+1)

Theory

Classification and distribution of field crops, definitions and concept of multiple cropping, mixed cropping, intercropping, relay and alley cropping, cultural practices for raising major cereals, pulses, oil seeds and fodder crops, green manuring, crop rotation.

Practical

Identification of crop plants, seeds and weeds. Preparation of cropping scheme. Application of herbicides in field crops.

7. Soil Science and Agril. Chemistry (SSC)

Course Code	Course title	Credit hours	Semester
SSC 102	Fundamental of Soil Science	3(2+1)	**I**
SSC 152	Soil Fertility and Nutrient Management	2(1+1)	**II**
SSC 153	Introductory Microbiology[#]	2(1+1)	**II**
SSC 252	Soil, Water and Plant Analysis	2(1+1)	**IV**
	Total	**9(5+4)**	

SSC 102: Fundamentals of Soil Science 2(1+1)

Theory

Composition of earth's crust, soil as a natural body – major components. Eluviations and alleviations formation of various soils. Physical parameters; texture – definition, methods of textural analysis, stock's law, assumption, limitations, textural classes, use of textural triangle; absolute specific gravity/particle density, definition, apparent specific gravity/bulk density – factors influencing, field bulk density. Relation between BD (bulk density), AD – practical problems. Pore space – definition, factors affecting capillary and non-capillary porosity, soil colour – definition, its significance, colour variable, value hue and chroma. Munsellcolour chart, factors influencing, parent material, soil moisture, organic matter, soil structure, definition, classification, clay prism like structure, factors influencing genesis of soil structure, soil consistency, plasticity, Atterberg's constants. Soil air, air capacity, composition, factors influencing, amount of air space, soil air renewal, soil temperature, sources and distribution of heat, factors influencing, measurement, chemical properties, soil colloids, organic, humus, inorganic, secondary silicate, clay, hydrous oxides. Ion exchange, cation-anion

importance, soil water, forms, hygroscopic, capillary and gravitational, soil moisture constants, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, energy concepts, PF scale, measurement, gravimetric – electric and tensiometer methods – pressure plate and pressure membrane apparatus – Neutron probe – soil water movement – classification – aerial photography – satellite of soil features – their interpretation; soil orders; land capability classification; soil of different eco-systems and their properties, Rock & Minerals classification, Pedogenic process. Objectives of soil science research institute in India (NBSS&LUP, ISSS, LTFE & NSSTL). Management of Soil Crusting, Soil Compaction and Soil Compression. Soil Biology benefits and harmful effects. Methods and objective of soil survey, Remote sensing application in soil and plant Studies, Soil degradation.

Practical

Collection and preparation of soil samples, estimation of moisture, EC, pH and bulk density. Textural analysis of soil by Robinson's pipette method. Description of soil profile in the field. Quantification of minerals and their abundance. Determination of Soil colour using Munsell Chart. Estimation of water holding capacity and hydraulic conductivity of soils. Estimation of Infiltration rate using double ring infiltrometer method. Estimation of soil moisture using gypsum block and neutron probe method. Soil compaction measurement with Pentrometer. Determination of pore space of soil. Determination of filed capacity and permanent wilting point of soil. Determination of soil water potential characteristic curves by tensiometer and pressure plate apparatus. Aggregate size distribution analysis of soil. Air capacity of soil by field method.

SSC 152: Soil Fertility and Nutrient Management 2 (1+1)

Theory

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, transformations and availability. Acid, calcareous and salt affected soils – characteristics and management. Soil organic matter, Role of microorganisms in organic matter- decomposition – humus formation. Importance of C:N ratio and pH in plant nutrition, soil buffering capacity. Integrated plant nutrient management. Soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions, deficiency symptoms, visual diagnosis. Plant nutrient toxicity symptoms and remedies measures. Soil test crop response and targeted yield concept. Biofertilizer. Nutrient use efficiency and management. Secondary and micronutrient fertilizer. Fertilizer control order. Manures and fertilizers classification and manufacturing process. Properties and fate of major and micronutrient in soils. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity.

Practical

Analysis of soil for organic matter, available N,P,K and Micronutrients and interpretations. Gypsum requirement of saline and alkali soils. Lime requirement of acid soils. Estimation of organic carbon content in soil. Determination of Boron and chlorine content In soil. Determination of Calcium, Magnesium and Sulphur in soil. Sampling of organic manure and fertilizer for chemical analysis. Physical properties of organic manure and fertilizers. Total nitrogen in urea and farmyard manure. Estimation of ammonical nitrogen and nitrate nitrogen in ammonical fertilizer. Estimation of water soluble P_2O_5, Ca and S in SSP, Lime and Gypsum. Estimation of Potassium in MOP/SOP and Zinc in zinc sulphate. Visiting of fertilizer testing laboratory.

SSC 153: Introductory Microbiology 2(1+1)

Theory

History and Scope of Microbiology: The discovery of micro-organism, spontaneous generation conflict, germ theory of diseases, microbial effect on organic and inorganic matter. Development of microbiology in India and composition of microbial world. Microscopy and Specimen Preparation: The bright field microscope, fixation, dyes and simple staining, differential staining. Difference between prokaryotic and eukaryotic cells. Prokaryotic cell structure and functions. Types of culture media and pre-culture techniques. Microbial growth in models of bacterial, yeast and mycelia growth curve. Measurement of bacterial growth. General properties of viruses and brief description of bacteriophages. DNA as genetic material. Antibiosis, symbiosis, intra-microbial and extra-microbial association. Sterilization methods – Physical and chemical, Isolation of pure cultures and preservation of cultures, Plant growth promoting microorganisms and mushrooms– Economical importance, Industrially important microorganisms in large scale production and common microbial fermentations. Mushrooms- edible and poisonous types, nutritive values, Culturing and production techniques.

Practical

Examination of natural infusion and living bacteria; examination of stained cells by simple staining and Gram staining. Methods for sterilization and nutrient agar preparation. Broth culture, agar slopes, streak plates and pour plats, turbid metric estimation of microbial growth, mushroom culture- Spawn production, Culture and production techniques, harvesting, packing and storage.

SSC 252: Soil, Water and Plant Analysis 2(1+1)

Theory

Methods of soil and plant sampling and processing for analysis. Characterization of hydraulic mobility – diffusion and mass flow. Renewal of gases in soil and their abundance. Methods of estimation of oxygen diffusion rate and redox potential. Use of radio tracer techniques in soil fertility evaluation. Soil micro-organisms and their importance. Saline, alkali, acid, waterlogged and sandy soils, their appraisal and management. Chemical and mineral composition of horticultural crops. Leaf analysis standards, index tissue, interpretation of leaf analysis values Quality of irrigation water. Radio tracer technology application in plant nutrient studies. Rapid tissue tests for soil and plant. Management of poor quality irrigation water in crop management. Soil and Water pollution.

Practical

Introduction to analytical chemistry, Collection and preparation of soil, water and plant samples for analysis. Determination of pH, electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage of soils. Estimation of available macro and micronutrient elements in soils and their contents in plants. Irrigation water quality analysis. Determination of pH and EC in irrigation water samples, Determination of Carbonates and bicarbonates in soil and irrigation water, Determination of Calcium and Magnesium in soil and irrigation water. Determination of N, P, K, Ca, Mg, Sand micronutrients in plant samples. Determination of Sodium, Potassium, Chlorine and Boron in irrigation water.

8. Genetics and Plant Breeding(GPB)

Course Code	Course title	Credit hours	Semester
GPB 102	Principles of Genetics and Cytogenetics	3(2+1)	**I**
GPB 151	Principles of Plant Breeding	3(2+1)	**II**
GPB 202	Fundamentals of Plant Biotechnology[#]	2(1+1)	**III**
	Total	**8(5+3)**	

GPB 102: Principles of Genetics and Cytogenetics 3 (2+1)

Theory

Historical background of genetics, theories and hypothesis. Physical basis of heredity, cell reproduction, mitosis, meiosis and its significance. Gametogenesis and syngamy in plants. Mendelian genetics–Mendel's principles of heredity, deviation from Mendelian inheritance, pleiotropy, threshold characters, co-dominance, penetrance and expressivity. Chromosome theory of inheritance, gene interaction. Modification of monohybrid and dihybrid rations. Multiple alleles, quantitative inheritance linkage and crossing over, sex linked inheritance and characters. Cytoplasmic inheritance and maternal effects. Chemical basis of heredity, structure of DNA and its replication. Evidence to prove DNA and RNA – as genetic material. Mutations and their classification. Chromosomal aberrations, changes in chromosome structure and number.

Practical

Study of fixatives and stains. Squash and smear techniques. Demonstrations of permanent slides and cell division, illustration in plant cells, pollen fertility and viability, determination of gametes, Solving problems of monohybrid, dihybrid, and test cross ratios using chi-square test, gene interactions, estimation of linkages using three point test cross from F_2 data and construction of linkage maps. Genetics variation in pea.

GPB 151: Principles of Plant Breeding 3 (2+1)

Theory

Plant breeding as a dynamic science, genetic basis of Plant Breeding – classical, quantitative and molecular, Plant Breeding in India – limitations, major achievements, goal setting for future. Sexual reproduction (cross and self-pollination), asexual reproduction, pollination control mechanism (incompatibility and sterility and implications of reproductive systems on population structure). Genetic components of polygenic variation and breeding strategies, selection as a basis of crop breeding and marker assisted selection Hybridization and selection – goals of hybridization, selection of plants; population developed by hybridization – simple crosses, bulk crosses and complex crosses. General and special breeding techniques. Heterosis – concepts, estimation and its genetic basis. Calculation of heterosis, heterobeltosis, GCA, SCA, inbreeding depression, heritability and genetic advance. Emasculation, pollination techniques in important horticultural crops. Breeding for resistance of biotic and abiotic stresses. Polyploidy breeding. Mutation breeding.

Practical

Breeding objectives and techniques in important horticultural crops. Floral biology – its measurement, emasculation, crossing and selfing techniques in major crops. Determination of mode of reproduction in crop plants, handling of breeding material, segregating generations (pedigree, bulk and back cross methods), Field layout, and maintenance of experimental records in self and cross pollinated crops. Demonstration of hybrid variation and production techniques. Hardy Weinberg Law and calculation, male sterility and incompatibility studies in horticultural crops calculation of inbreeding depression, heterosis, heterobeltioses, GCA, SCA, GA, heritability.

GPB 202: Fundamentals of Plant Biotechnology 2(1+1)

Theory

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement: Totipotency and Morphogenesis, Nutritional requirements of in-vitro cultures; Techniques of In-vitro cultures, Micropropagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture; Applications and Achievements; Somaclonal variation, Types, Reasons: Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering; Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications. Blotting techniques – DNA finger printing – DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement. Nanotechnology: Definition and scope, types of nano material and their synthesis, green synthesis. Tools and techniques to characterize the nano particles. Nano-biotechnological applications with examples, Nano toxicology and safety.

Practical

Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Micro propagation of important crops; Anther, Embryo

and Endosperm culture; Hardening / Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast; Demonstration of Culturing of protoplast; Demonstration of Isolation of DNA; Demonstration of Gene transfer techniques, direct methods; Demonstration of Gene transfer techniques, indirect methods; Demonstration of Confirmation of Genetic transformation; Demonstration of gel-electrophoricsis techniques. Green synthesis of nano particles and their size characterization.

9. Seed Science and Technology(SST)

Course Code	Course title	Credit hours	Semester
SST 101	Introductory Crop Physiology	2(1+1)	I
	Total	**2(1+1)**	

SST 101: Introductory Crop Physiology 2(1+1)

Theory

Water Relations in Plants: Role of water in plant metabolism, osmosis inhibition, diffusion, water potential and its components, measurement of water potential in plants, absorption of water, mechanism of absorption and ascent of sap. Stomata: Structure, distribution, classification, mechanism of opening and closing of stomata. Osmotic pressure, guttation, stem bleeding; transpiration methods and mechanism and factors affecting transpiration. Drought: Different types of stresses; water, heat and cold tolerance; mechanism of tolerance. Plant Nutrition: Essentiality, mechanism of absorption and its role in plant metabolism. Biological Nitrogen Fixation Photosynthesis, structure and function of chloroplast, dark and light reactions, cyclic and non-cyclic electron transfer, CO_2 fixation – C3, C4 and CA metabolism, advantages of C4 pathway. Photorespiration and its implications, factors affecting photosynthesis. Mode of herbicide action, Secondary metabolites and plant defense.

Practical

Measurement of water potential, osmosis, root pressure, structure of the stomata, distribution, opening and closing of the stomata, measurement, transpiration and calculation of transpirational pull demonstration. Importance of light and chlorophyll in photosynthesis, pigment identification in horticultural crops, measurement of relative water content (RWC), studying plant movements.

10. Agricultural Entomology(ENT)

Course Code	Course title	Credit hours	Semester
ENT 152	Fundamentals of Entomology	**3(2+1)**	**II**
ENT 201	Nematode pests of horticultural crops and their Management	**2(1+1)**	**III**
ENT 251	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	**3(2+1)**	**IV**
ENT 352	Insect Pests of Vegetable, Ornamental and Spice Crops	**3(2+1)**	**VI**
ENT 353	Apiculture, Sericulture and Lac culture	**2(1+1)**	**VI**
	Total	**13 (8+5)**	

ENT 152: Fundamentals of Entomology 3(2+1)

Theory

Introduction to phylum arthropoda. Importance of class Insecta. Insect dominance. History of entomology in India, Importance of entomology in different fields. Definition, division and scope of entomology. Comparative account of external morphonology-types of mouth parts, antennae, legs, wings and genetalia. Structure, function of cuticle & moulting and body segmentation, Anatomy of digestive, Circulatory, Sensory, respiratory, glandular, excretory, nervous and reproductive systems. Types of reproduction. Postembryonic development-eclosion. Matamorphosis. Types of egg larvae and pupa. Classification of insects upto orders, sub-order and families of economic importance and their distinguished characters. Plant mites – morphological features, important families with examples.

Practical

Insect collection and preservation. Identification of important insects. General body organization of insects. Study on morphology of grasshopper or cockroach. Preparation of permanent mounts of mouth parts, antennae, legs and wings. Dissection of grasshopper and caterpillar for study of internal morphology. Observations on metamorphosis of larvae and pupae. Dissection of cockroaches.

ENT 201: 2(1+1)

Nematode Pests of Horticultural Crops and their Management

Theory

History and development of nematology - definition, economic importance. General characters of plant parasitic nematodes, their morphology, taxonomy, classification, biology, symptomatology and control of important plant parasitic nematodes of fruits – (tropical, sub-tropical and temperate) vegetables, tuber, ornamental, spice and plantation crops. Role of nematodes in plant disease complex. Integrated nematode management.

Practical

Methods of sampling and extraction of nematodes from soil and plant parts, killing, fixing and preparation of temporary and permanent nematode mounts. Nematicides and their use. Collection and preservation of 20 plant species/parts damaged by plant parasitic nematodes.

ENT 251: Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops 3(2+1)

Theory

General – economic classification of insects; Bio-ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops; pest surveillance. Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops like coconut, areca nut, oil palm, cashew, cacao, tea, coffee, cinchona, rubber, betel vine senna, neem, belladonna, pyrethrum, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and. Storage insects – distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their maximum residue limits (MRLs).

Practical

Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect – pests affecting fruits, plantation, medicinal and aromatic crops in field and storage.

ENT 252:

Insect Pests of Vegetable, Ornamental and Spice Crops 3(2+1)

Theory

Economic importance of insects in vegetable, ornamental and spice crops -ecology and pest management with reference to these crops. Pest surveillance in important vegetable, ornamental and spice crops. Distribution, host range, bio-ecology, injury, integrated management

of important insect-pests affecting vegetable, ornamental and spice crops. Important storage insect-pests of vegetable, ornamental and spice crops, their host range, bio-ecology, injury and integrated management. Insect –pests of processed vegetables and ornamental crops, their host range, bio-ecology, injury and integrated management. Insecticidal residue problems in vegetables and ornamental crops, tolerance limits etc.

Practical

Study of symptoms, damage, collection, identification, preservation, assessment of damage/population of important insect-pests affecting vegetable, ornamental and spice crops in field and during storage.

ENT 353: Apiculture, Sericulture and Lac culture 2(1+1)

Theory

Introduction to beneficial insects. Importance and History of apiculture. Species of honey bees, Rock bee, Little bee, Indian bee, European bee, Italian bee and Dammar bee, lifecycle and caste determination. Bee colony maintenance, bee colony activities, starting of new colony, location site, transferring colony, replacement of queen, combining colonies, swarm prevention, colony management in different seasons, Equipment for apiary, types of bee hives and their description. Bee pasturage. Honey extraction, honey composition and value, bee wax and tissues.. Importance, History and development in India, silkworms kinds and their hosts, systematic position, distribution, lifecycles in brief, Silk glands. Mulberry silkworm-morphological features, races, rearing house and equipments, disinfection and hygiene. Grainage acid treatment, packing and transportation of eggs, Incubation, black boxing, hatching of eggs. Silkworm rearing young age /chawki rearing and old age rearing of silkworms. Feeding, spacing, environmental conditions

and sanitation. Cocoon characters colour, shape, hardiness and shell ratio. Defective cocoons and stifling of cocoons. Uses of silk and by-products. Economics of silk production. Moriculture-Mulberry varieties, package of practices, Pests and diseases and their management. Lac growing areas in India, Lac insects, biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac-insects.

Practical

Honey bee colony, different bee hives and apiculture equipment. Summer and Winter management of colony. Honey extraction and bottling. Study of pests and diseases of honeybees. Establishment of mulberry garden. Preparation of mulberry cuttings, planting methods under irrigated and rainfed conditions. Maintenance of mulberry garden-pruning, fertilization, irrigation and leaf harvest. Mulberry pests and diseases and their management and nutritional disorders. Study of different kinds of silkworms and mulberry silkworm morphology, silk glands. Sericulture equipments for silkworm rearing. Mulberry silkworm rearing room requirements. Rearing of silkworms-chalky rearing. Rearing of silkworms late age silkworm rearing and study of mountages. Study of silkworm pests and their management. Study of silkworm diseases and its management. Lac insects-biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac insects.

11. Plant Pathology (PPA)

Course Code	Course title	Credit hours	Semester
PPA 202	Fundamentals of Plant Pathology	**3(2+1)**	**III**
PPA 251	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	**3(2+1)**	**IV**
PPA 302	Diseases of Vegetables, Ornamentals and Spice Crops	**3(2+1)**	**V**
	Total	**9(6+3)**	

PPA 202: Fundamentals of Plant Pathology 3(2+1)

Theory

Introduction to the science of phytopathology, its objectives, scope and historical background. Classification of plant diseases, symptoms, signs, and related terminology. Parasitic causes of plant diseases (fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants), their characteristics and classification. Non-parasitic causes of plant diseases. Infection process. Survival and dispersal of plant pathogens. Plant disease epidemiology, forecasting and disease assessment. Principles and methods of plant disease management. Integrated plant disease management. Fungicides classification based on chemical nature, Commonly used fungicides, bactericides and nematicides.

Practical

Familiarity with general plant pathological laboratory and field equipments. Study of disease symptoms and signs and host parasite relationship. Identification and isolation of plant pathogens. Koch's postulates. Preparation of fungicidal solutions, slurries, pastes and their applications.

PPA 251: 3(2+1)

Diseases of Fruit, Plantation, Medicinal and Aromatic Crop

Theory

Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of fruits, plantation, medicinal and

aromatic crops *viz* mango, banana, grape, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, ber, apple, pear, peach, plum, almond, walnut, strawberry, areca nut, coconut, oil palm, coffee, tea, cocoa, cashew, rubber, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and Tephrosia. Important post-harvest diseases of fruit, plantation and medicinal and aromatic crops and their management.

Practical

Observations of disease symptoms, identification of casual organisms and host parasite relationship of important diseases. Examination of scrapings and cultures of important pathogens of fruits, plantation, medicinal and aromatic crops.

PPA 302:

Diseases of Vegetable, Ornamental and Spice Crops 3(2+1)

Theory

Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following vegetables, ornamental and spice crops: tomato, brinjal, chilli, bhindi, cabbage, cauliflower, cucumber, squash, parwal, radish, knol-khol, pea, beans, beet root, onion, garlic, fenugreek, ginger, potato, turmeric, pepper, cumin, cardamom, , coriander, clove, cinnamon, jasmine, rose, , tuberose, gerbera, anthurium,. Important post-harvest diseases of vegetables and ornamental crops and their management.

Practical

Observations of symptoms, causal organisms and host parasitic relationship of important diseases, examination of cultures of important pathogens of vegetables, ornamental and spice crops in field as well as in protected cultivation.

12. Agricultural Extension (EXT)

Course Code	Course title	Credit hours	Semester
EXT 102	**Communication Skills and Personality Development#**	2(1+1)	**I**
EXT 103	**Human Values and Ethics#**	1(1+0)**	**I**
EXT 104	**Physical Education & Yoga Practices#**	2(0+2)**	**I**
EXT 152	**Fundamentals of Extension Education**	2 (1+1)	**II**
EXT 302	**Entrepreneurship Development and Business Management**	2(1+1)	**V**
	Total	**8(4+4)**	

EXT-102: Communication Skills and Personality 2 (1+1)
Theory

Communication: Meaning and process of communication, verbal and nonverbal communication, individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences, oral presentation skills, visual communication, body language, Interviews: kinds, Importance and process Structural and functional Grammar: Introduction of Word Classes; Structure of Verb in English; Uses of Tenses; Study of Voice; Study of Conjunctions and Prepositions; Sentence Patterns in English.

Spoken English: Conversations of different situations in everyday life, the concept of stress, stress shift in words and sentences, silent letters in words and pronunciation of words with silent letters, the basic intonation patterns.

Comprehension skill: Reading and comprehension of general and technical articles.

Writing skill: Paragraph writing, précis writing, report writing, synopsis writing and proposal writing, summarizing, abstracting, field diary and lab record, indexing, footnote and bibliographic procedures, preparation of Curriculum Vitae and Job applications.

Practical

Structural Grammar: Exercises in word classes, identification and study of verbs in sentences, application of tenses and voice, exercises in conjunctions and prepositions, other structural grammar exercises, report writing, letter writing (different types of letters).

Spoken English: Conversations of everyday life, the concept of stress, stress shift. Silent letters in words, basic intonation patterns, preparing and address.

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures, précis writing, summarizing, abstracting, synopsis writing and proposal writing, CV writing, group discussions.

EXT 103: Human Value and Ethics 1(1+0)

Theory

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

EXT 104: Physical Education & Yoga Practices[#] 2(0+2)
Practical

Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules are regulations of important games, skill development in any one of the games – football, hockey, cricket, volleyball, ball badminton, throw ball, tennikoit. Participation in one of the indoor games – shuttle badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events – broad jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, Safety education, movement education, effective way of doing day-today activities. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience. Importance of Asanas and Surya namaskar. Free hand exercises and Yoga. Recreation: definition, agencies promoting recreation, camping and recreation.

Note: Warming up and conditioning exercises are compulsory before the commencement of each class.

EXT 152: Fundamentals of Extension Education 2 (1+1)
Theory

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Horticulture extension: process, principles and selected programmes of leading national and international forest institutes. People's participation in Horticulture programmes. Motivation of Farmers, rural youth and voluntary organizations for Horticulture extension work Rural Development: meaning, definition, objectives and genesis. Transfer of technology

programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR. Communication: meaning, definition, elements and selected models. Audio – visual aids: importance, classification and selection. Adoption and diffusion process, Teaching and learning-concepts and principles, Teaching steps, Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership. ICT in Extension education, ICT use in rural India.

Practical

Visits to study structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/Mahila Mandal, Village Panchayat, State Dept. of Horticulture /All India Radio (AIR). Exercises on distortion of message, script writing for farm broadcasts and telecasts, planning, preparation & use of NPVA like poster, chart, flash cards, folders etc. and AVA like OHP & 35 mm slide projector transparencies. Identification of local leaders to study their role in extension work. Evaluation of some selected case studies of forestry extension programmes. Preparation of Village Agricultural productions plan.

EXT 302: Entrepreneurship Development and Business Management 2(1+1)

Theory

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Supply chain management and total quality management. Overview of horti inputs industry. Characteristics of Indian horticultural processing and export industry. Social Responsibility of Business.

Practical

Assessing entrepreneurial potential, problem solving ability, managerial skills and achievement motivation, exercise in creativity, time audit, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

13. Agricultural Economics(ECO)

Course Code	Course title	Credit hours	Semester
ECO 102	Fundamentals of Economics and Marketing	3(2+1)	**I**
ECO 352	Horti-Business Management	3(2+1) **	**VI**
	Total	**6(4+2)**	

ECO 102: Fundamentals of Economics and Marketing 3(2+1)

Theory:

Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption – theory of consumer behaviour, laws of consumption, classification of goods. Wants – their characteristics and classification, utility and its measurement, cardinal and ordinal, law of diminishing marginal utility, law of equi-marginal utility, indifference curve and its properties. Theory of demand, demand schedule and curve, market demand. Price, income and cross elasticities, Engil's law of family expenditure – consumer's surplus. Theory of firm, factors of production – land and its characteristics, labour and division of labour, theories of population. Capital and its characteristics – classification and capital formation. Enterprises – forms of business organization – merits and demerits. Laws or return – law of diminishing marginal return, Law of supply – supply schedule and curve elasticities. Market equilibrium, Marketing-definition – Marketing Process – Need for marketing – Role of marketing –– Marketing functions – Classification of markets – Marketing channels – Price spread – Marketing Efficiency – Integration – Constraints in marketing of agricultural produce. Market intelligence, Concept of future market

Practical: Preparation of Bankable projects for various agricultural products and its value added products. Identification of marketing channel– Calculation of Price Spread – Identification of Market Structure – Visit to different Markets.

ECO 352: Horti-Business Management 3 (2+1)

Theory: Farm management - definition, nature, characteristics and scope. Farm management principles and decision making, production function, technical relationships, factors, product, relationship – factors relationship, product relationship, optimum conditions, principles of opportunity cost-equi-marginal returns and comparative advantages, time value of money, economic of scale, returns to scale, cost of cultivation and production, break even analysis, decision making under risk and uncertainty. Farming systems and types. Management Planning – meaning, steps and methods of planning, types of plan, characteristics of effective plans. Organizations – forms of business organizations, organizational principles, division of labour. Unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability. Direction – guiding, leading, motivating, supervising, coordination – meaning, types and methods of controlling – evaluation, control systems and devices. Budgeting as a tool for planning and control. Record keeping as a tool of control. Functional areas of management – operations management – physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality. Materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ).

Personnel management – recruitment, selection and training, job specialization. Marketing management – definitions, planning the marketing programmes, marketing mix and four P's. Financial management – financial statements and rations, capital budgeting. Project management – project preparation evaluation measures.

Practical:

Study of Horti-input markets: Seed, fertilizers, pesticides. Study of output markets:fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, NABARD. Preparations of projects and Feasibility reports for Horti-business entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of horti-based industries. Trend and growth rate of prices of horti-cultural commodities.

14. Agricultural Statistics (AST)

Course Code	Course title	Credit hours	Semester
AST 101	Elementary Statistics	2(1+1)	**I**
AST 102	Elementary Mathematics[#]	2(2+0)*	**I**
AST 201	Agri- Informatics and Computer Application[#]	2(1+1)	**III**
	Total	**6(4+2)**	

AST 101: Elementary Statistics 2(1+1)

Theory:

Basic Concept: Introduction to statistics, Limitations of statistics, variable, statistic, parameter, types and sources of data, construction of frequency distribution tables, graphical representation of data, Measures of location and dispersion for raw and grouped data.

Probability and Distributions: Theory of Probability: Definitions (Classical, Empirical, Axiomatic) of Probability; Theorem on Total and Compound Probability (For two events only without proof), Random variable: Probability Mass Function and Probability Density Function; Mathematical Expectation and Variance; Theoretical Distributions: Binomial Distribution, Poisson distribution – Derivation of their mean and variance only.

Correlation and Regression: Simple Correlation and Regression.

Sampling: Basic concept of sampling, Advantages of Sample Survey over Census Survey; Simple Random Sampling (SRS), SRSWR and SRSWOR; Estimators of Population Mean, Total and their Variances (formulae only) for SRS; Concepts of Sampling Errors and Non-sampling Errors.

Test of Significance: Concept of Statistical Hypotheses, Critical Region, Acceptance Region, Level of Significance; Type I Error, Type II Error, Power of a Test and Test of Significance, Application of t, chi-square and F Statistics.

Experimental Design: Basic concept, Completely Randomized Design, Randomized Block Design and Latin Square design.

Practical: Construction of Frequency Distribution from Ungrouped and Grouped Data; Calculation of different measures of Location and Dispersion from Ungrouped and Grouped frequency distributions.

Calculation of simple correlation coefficient; Fitting of Linear Regression Equations.

Application of t, chi-square and F Statistics for Test of Significance in different statistical problems.

Analysis of data from experiments laid out in CRD, RBD and LSD.

AST 102: Elementary Mathematics 2 (2+0)

Theory

Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a

circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2,y_2), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line y = mx + c to the given circle $x^2 + y^2 = a^2$.Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , sin x & cos x from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form y=f (x) (Simple problems based on it).

Integral Calculus : Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation**.**

AST 201: Agri-informatics & Computer Application 2(1+1)

Theory:

IT and its importance. IT tools, IT-enabled services and their impact on society; computer fundamentals; Definition and Characteristics of computers; Organization of computers; Computer Generations; Classifications of Computers; Data representation in Computer, Word and character representation; Hardware and

software; Computer memory & permanent storage devices, Input and output devices; Logic gates, Adder circuit, Binary addition and subtraction; Introduction to programming languages, features of machine language, assembly language, high-level language and their advantages and disadvantages; Principles of programming-algorithms and flowcharts; BASIC language, concepts, basic and programming techniques; Operating systems (OS) - definition, basic concepts & types; Internet and World Wide Web (WWW), Concepts and components, HTML and IP.

Practical

Introduction to WINDOWS Operating Systems; MS Word; MS Excel; MS Power Point; MS Word- Features of word processing, creating document and tables and printing of document, MS Excel-Concept of electronic spreadsheet, creating, editing and saving of spreadsheet, inbuilt statistical functions and formula bar, Analysis of data using MS Excel. MS Power point-preparation, presentation of slides and slide show. Internet applications: Web Browsing, Creation and operation of Email account.

15 Biochemistry(BCH)

Course Code	Course title	Credit hours	Semester
BCH 151	Fundamentals of Plant Biochemistry#	3(2+1)	II
	Total	**3(2+1)**	

Elementary Plant Biochemistry **2(1+1)**

Theory

Carbohydrates: Occurrence, classification and structure, physical and chemical properties of carbohydrates, isomerism, optical activity, reducing property, reaction with acids and alkalis, ozone formation. Lipids: Classification, important fatty acids and triglycerides, essential fatty acids. Physical and chemical control of oils, their rancidity, phospholipids, types and importance. Plant pigments – structure and function of chlorophyll and carotenoids, sterols, basic structure, role of brassino sterols in plants. Proteins: Classification, function and solubility, amino acids – classification and structure, essential amino acids, properties of amino acids, colour reactions, amphoteric nature and isomerism; structure of proteins –primary, secondary tertiary and quaternary properties and reaction of proteins. Enzymes: Classification and mechanism of action; factors affecting enzyme action, co-factors and coenzymes. Vitamins and minerals as co-enzymes/co-factors. Carbohydrate metabolism – glycolysis and TCA-cycle; metabolism of lipids, fatty acid oxidation, biosynthesis of fatty acids, electron transport chain, bioenergetics of glucose and fatty acids, structure and function of nucleic acid replication, transcription and translation.

Practical

Preparation of standard solutions and reagents; Carbohydrates: Qualitative reactions; Estimation of starch; Estimation of reducing and non reducing sugars from fruits; Amino acids: Reactions of amino acids; Proteins: Estimation of proteins by Lowry's method; Fatty acids: Estimation of free fatty acids; Determination of iodine number of vegetable oils; Vitamins: Estimation of Ascorbic acid; Techniques: Paper chromatography, Thin layer chromatography; Electrophoresis of pigments extracted from flowers, Extraction of oil from oil seeds; Enzymes: Enzyme assay, Enzyme Immobilization.

16 Agricultural Engineering(AE), Faculty of Technology

Course Code	Course title	Credit hours	Semester
AEN 251	Farm Machinery and Power	2(1+1)	IV
	Total	**2(1+1)**	

AEN 251: Farm Machinery and Power 2(1+1)

Theory

Basic concepts of various forms of energy, unit and dimensions of force energy and power, calculations with realistic examples. IC Engines: Basic principles of operation of compression, ignition and spark ignition engines, two stroke and four stroke engines, cooling and lubrication system, power transmission system, broad understanding of performance and efficiency, tractors, power tillers and their types and uses. Electric motors: types, construction and performance comparison. Tillage: objectives, method of ploughing. Primary tillage implements: construction and function of indigenous ploughs, improved indigenous ploughs, mould board ploughs, disc and rotary ploughs. Secondary tillage implements: construction and function of tillers, harrows, levelers, ridgers and bund formers. Sowing and transplanting equipment: seed drills, potato planters, seedling transplanter. Grafting, pruning and training tools and equipment. Inter-culture equipment: sweep. Junior hoe, weeders, long handle weeders. Crop harvesting equipments: potato diggers, fruit pluckers, tapioca puller and hoists.

Practical

Calculation on force, power and energy. IC engines – showing the components of dismantled engines and motors. Primary and secondary tillage implements, hitching, adjustments and operations. Spraying equipment, calibration and operation. Plant protection equipment, calculation of dilution ratio and operation.

Student READY *(Rural Entrepreneurship Awareness and Development Yojana)* Programme (launched by the Hon'ble Prime Minister on 25th July, 2015) for VII and VIII Semesters 40(0+40)

Semester - VII

Student READY- Rural Horticulture Work Experience (RHWE): Placement in Villages & Placement in Industries: These programs will be taken up during the VII semester for a duration of 24 weeks and will be allotted 0+20 credit hours. The program will include orientation, village stay, all India study tour, industrial placement program, report writing and final examination.

S.N.	Course Code	Title of the Course	Credit Hours
1	**SR 401**	Student READY- Placement in Villages	0+10
2	**SR 402**	Student READY - Placement in Industries	0+10
		Total	**20 (0+20)**

S.N.	RHWE Programme Schedule	Duration
1	Orientation Programme	2 weeks
2	Village stay	12 weeks
3	All India Study Tour (if not completed in earlier semesters)	3 weeks
4	Industrial Placement Programme	4 weeks
5	Report Writing & Final Examination	3 weeks
Total		**24 Weeks**

Student READY- Placement in Villages

Objectives:

1. To provide an opportunity to the students to understand the life situations in the villages, rural institutions, socio-economic conditions and constraints faced by the farming community.

2. To get the students familiar with the socio-economic conditions of the farmers and their problems with reference to agricultural development.

3. To impart diagnostic and remedial practical training and skills in crop production / horticulture / plant protection through work experience.

4. To develop the understanding regarding agricultural technologies being followed by farmers and to prepare alternate farm plans according to the local situation in consultation with the farmers.

5. To help the students to acquaint with ongoing thrust on rural development and programmers related to transfer of technology (TOT) programme related to horticulture and allied aspects..

6. To provide an opportunity to work with KVK's/Research Stations/Development Centre and rural horticulture based industries.

7. To develop the communication skills, confidence and competence among the students to interact with the farmers so as to prepare Project Reports on "Village Development Plan".

Expected Outcome:

1. Personality development
2. Art of listening and art of negotiation
3. Confidence building
4. Develop skill of joint effort (community management)
5. Developing art of creative thinking
6. Effective decision-making
7. Life's real experiences
8. Time and relationship management
9. Observe problem and possible solution (crisis management)
10. Understanding and practicing local (ITK) and scientific methods
11. Working of local institution/organization.

Course Work:

The **Student READY- Rural Horticulture Work Experience (RHWE) : Placement in Villages** consists of the following courses equivalent to a load of 10 credits.

Sl No.	Course title	Credits
1.	Crop production	5
2.	Plant protection	2
3.	Rural economics	1
4.	Extension programme Activities of the NGO/Govt.	1
5.	Org./KVK/Research Station	1
	Total	**10**

1. Crop production - 5 credits

The students will involve themselves to:

- Follow & work in respect of day-to-day operations along with the host farmers
- Maintain crop-wise record of horticultural operations in a diary
- Make critical observations and ascertain the reasons for non-adoption of recommended package of practices for the crops of the host farmer
- Record of production problems confronted by the host farmer
- Record of biometrical observations for minimum of three crops in the proforma prescribed and analyze for their performance in comparison to recommended horticultural technology
- Maintain a record of daily work done in the Performa prescribed

2. Plant protection (Entomology and Plant Pathology) - 2 credits

The students will be involved in conducting the following:

- Identification of insect pests, diseases, nutritional disorders, weeds and other physiological disorders in standing crop
- Maintenance of record of plant protection work undertaken in the prescribed proforma for a minimum of three crops
- Make critical observations on adoption of recommended plant protection measures for the control of diseases and insect pests of the crops
- Record the observations on plant protection separately for insect pests diseases
- Demonstration of preparation of fungicide/insecticidal spray fluids for important plant protection measures

- Submission of 10 herbarium specimens each of insect damage, plant disease symptoms nutritional disorders, weeds and physiological disorders of any of the crops grown in the village.

3. Rural Economics - 1 credit

The students will be involved in conducting the following:

- Collection of data on economic status/condition of the village, resources endowment and its utilization, population, cropping patterns, irrigation source, vital statistics, labour problems, employment and other economic aspects as per prescribed Performa/questionnaire
- Conduct of farm holding survey as per prescribed Performa and working out cost of cultivation of principal crops grown by the host farmer and one other category of farmer (if host farmer is large farmer, the other farmer should be a small/ marginal farmer and vice-versa)
- Participation in anyone of the vocational trainings listed

4. Extension programme - l credit

The students will be involved in conducting the following:

- Identification' of major horticultural problems of the village through participatory rural
- Appraisal (PRA) techniques
- Study of on-going central/state sponsored rural development and extension programmes and identification of extension approaches in the rural development programmes
- Visit to village institutions to study their role in development programmes and extension work

5. Activities of the NGO/KVK/Research Station/Govt. Org. - 1 credit

The students shall be given an opportunity to acquaint themselves with the various NGO/Govt. Org./KVK/Research Station activities /

programmes concerned and also the agro climate zone in which it is located. The principles and methodologies involved in conducting different types of experiments / trials, FLDs, collection and analysis of experimental data, maintenance of farm records etc., shall be explained to them. The students will observe closely different aspects of research/extension programmes / activities with the guidance of scientists of the respective centers. They shall maintain a record of the titles of technical programmes for various research projects undertaken at the NGO/Govt. Org./KVK/Research Station. They must also record all the items of work either carried out by them or shown to them. This exercise shall be done whenever all the students visit NGO/Govt. Org./KVK/Research station. During the period, when the host farmer does not have much day-to-day work on his holding, or upon completion of work in the villages, the students can better attend the work at the NGO/Govt. Org./KVK/research station concerned. During the visit, the student must record meteorological data of the preceding week / fortnight if available and possible.

The programme will be conducted following the Manual made for the purpose and data pertaining to all the courses are to be recorded regularly in the student's diary and presented in its Group Report with colour photographs for the batch of the students.

Student READY - Placement in Industries

Students shall be placed in Agro-and Horti-based industries and Commodities Boards for 04 weeks. Industries include seed/sapling, fertilizer, pesticides, insecticides, organic input, etc. production, post-harvest management, processing-value addition, agri-finance institutions, reputed commercial horticulture farm, etc.

Activities and Tasks during Placement in Industries:

1. Acquaintance with industry and staff
2. Study of structure, functioning, objective and mandates of the industry
3. Study of various processing units and hands-on trainings under supervision of industry staff
4. Ethics of industry
5. Employment generated by the industry
6. Contribution of the industry promoting environment
7. Learning business network including outlets of the industry
8. Skill development in all crucial tasks of the industry
9. Documentation of the activities and task performed by the students
10. Performance evaluation, appraisal and ranking of students

Day to day activities is to be recorded regularly in the student's diary and presented in its Group Report with colour photographs for the batch of the students.

Semester –VIII

Student READY: Experiential Learning Programmes (Professional Package) will be for the duration of 20 weeks and will carry a weightage of 0+20 credit hours. Students can select any two modules from the following under **Student READY- Experiential Learning Programmes** depending on the facilities available at the Faculty:

S.N.	Course Code	Title of the Module (any two)	Credit Hours
Student READY: Experimental Learning programmes			**20 (0+20)**
1	**SR 451**	Module 1	**10 (0+10)**
2	**SR 452**	Module 2	**10 (0+10)**

S.N.	Title of the Course Module (any two)	Credit Hours
Student READY: Experimental Learning programme		20 (0+20)
1	Commercial Horticulture	10 (0+10)
2	Protective Cultivation of High Value Horticulture Crops	10 (0+10)
3.	Mass Multiplication of Plant And Molecules through Tissue Culture	10 (0+10)

Module- **Commercial Horticulture**: Nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control. Nursery production of ornamentals: Production of plantlets, production of potted plants, management and maintenance, sale and marketing. Protected cultivation of vegetables and flowers: Nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control, marketing and cost analysis.

Module- **Protective Cultivation of high Value Horticulture Crops:** Visit to commercial polyhouses, Project preparation and planning. Specialised lectures by commercial export house. Study of designs of green- house structures for cultivation of crops. Land preparation and soil treatment. Planting and production: Visit to export houses; Market intelligence; Marketing of produce; cost analysis; Visit to export houses; Market intelligence; Marketing of produce; cost analysis; institutional management.

Module- **Mass multiplication of plants and molecules through tissue culture**: Preparation of sock solutions of tissue culture media. Preparation of solid media and liquid media. Initiation of in vitro culture and multiplication (preparation of explant, inoculation and culturing) (crop to be selected). Sub-culturing, Hardening and

establishment, Initiation of callus cultures – suspension cultures, Induction of selected biomolecules in callus, Harvesting and extraction of biomolecule, Marketing and cost analysis.

CONDUCTION & EVALUATION OF STUDENT READY PROGRAMME

1. The Dean will designate component wise Coordinator, Managing Director, Manager, etc. as required and evaluation committee for its conduction and evaluation as per the concerned ICAR guidelines.
2. Students shall be evaluated component-wise.
3. Since the credit hours allotted to the Student READY program are gradial, the minimum condition of attendance of 85% as per the concerned ICAR guidelines and grading system will apply for the programme component as will be applicable to other courses.
4. It is expected that at the end of Student READY programme, the students should gain competency for entrepreneurship, which should be innovative and creative in nature. The evaluation committee must ensure percentage increase in this competency at the end & successful organization of all components of the Student READY Programme.
