

**B.Sc. Horticulture [4-Year, 8- Semester]
CHOICE BASED CREDIT SYSTEM (CBCS)**

**B.Sc. Horticulture
[4-Year, 8- Semester]
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Effective from Academic Year 2015-2016

**H.N.B. GARHWAL UNIVERSITY
(A Central University)
Srinagar – Garhwal
Uttarakhand**

DEPARTMENT OF HORTICULTURE
H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand, India-246 174
Course Curriculum for B. Sc. Horticulture, 2015-16 under CBCS Course offered

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester I					
Core					
SOA/HC 101 T	Fundamentals of Geology and Soil Science	100	30	70	2
SOA/HC 101 P	Fundamentals of Geology and Soil Science	100	-	100	1
SOA/HC 102T	Elementary Plant Biochemistry & Biotechnology	100	30	70	2
SOA/HC 102 P	Elementary Plant Biochemistry & Biotechnology	100	-	100	1
SOA/HC 103 T	Principles of Plant Physiology	100	30	70	2
SOA/HC 103 P	Principles of Plant Physiology	100	-	100	1
SOA/HC 104 T	Statistics & Computer Application	100	30	70	2
SOA/HC 104 P	Statistics & Computer Application	100	-	100	1
Ability Enhancement Compulsory Course (AECC)					
SOA/HAECC T 101	Structural Grammar and Spoken English	100	30	70	1
SOA/HAECC P 101	Structural Grammar and Spoken English	100	-	100	1
Elective					
Student has to earn 6 credits from the electives. Student can choose any elective from same department or other department of School of Agriculture & Allied Sciences.					
SOA/HE 101 T	Introductory Economics	100	30	70	2
SOA/HE 102 T	Applied Mathematics	100	30	70	2
SOA/HE 103 T	Introductory Biology	100	30	70	1
SOA/HE 103 P	Introductory Biology	100	-	100	1
SOA/HE 104 T	Sericulture	100	30	70	1
SOA/HE 104 P	Sericulture	100	-	100	1
Total Credit to earn in the semester I					
Core	AECC	SEC	Elective	Total	
12	2	-	6	20	

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

T- Theory
P-Practical

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester II					
Core					
SOA/HC 105 T	Introductory Microbiology	100	30	70	1
SOA/HC 105 P	Introductory Microbiology	100	-	100	1
SOA/HC 106 T	Principles of Genetics and Cytogenetics	100	30	70	2
SOA/HC 106 P	Principles of Genetics and Cytogenetics	100	-	100	1
SOA/HC 107 T	Apiculture	100	30	70	1
SOA/HC 107 P	Apiculture	100	-	100	1
SOA/HC 108 T	Medicinal and Aromatic Plants	100	30	70	2
SOA/HC 108 P	Medicinal and Aromatic Plants	100	-	100	1
SOA/HC 109 T	Soil Fertility and Nutrient Management	100	30	70	1
SOA/HC 109 P	Soil Fertility and Nutrient Management	100	-	100	1
Ability Enhancement Compulsory Course (AECC)					
SOA/HAECC T 102	Environmental Science	100	30	70	1
SOA/HAECC P 102	Environmental Science	100	-	100	1
Elective					
Student has to earn 6 credits from the electives. Student can choose any elective from same department or other department of School of Agriculture & Allied Sciences.					
SOA/HE 105T	Fundamentals of Extension Education	100	30	70	1
SOA/HE 105P	Fundamentals of Extension Education	100	-	100	1
SOA/HE 106T	Fundamentals of Horticulture	100	30	70	1
SOA/HE 106P	Fundamentals of Horticulture	100	-	100	1
SOA/HE 107T	Agrometeorology	100	30	70	1
SOA/HE 107P	Agrometeorology	100	-	100	1
SOA/HE 108T	Introductory Agroforestry	100	30	70	1
SOA/HE 108P	Introductory Agroforestry	100	-	100	1
Total Credit to earn in the semester II					
Core	AECC	SEC	Elective	Total	
12	2	-	6	20	

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

T- Theory
P-Practical

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester III					
Core					
SOA/HC 110 T	Tropical and Subtropical Fruits	100	30	70	2
SOA/HC 110 P	Tropical and Subtropical Fruits	100	-	100	1
SOA/HC 111 T	Weed Management in Horticultural Crops	100	30	70	1
SOA/HC 111P	Weed Management in Horticultural Crops	100	-	100	1
SOA/HC 112T	Tropical and Subtropical Vegetables	100	30	70	2
SOA/HC 112P	Tropical and Subtropical Vegetables	100	-	100	1
SOA/HC 113T	Orchard Management	100	30	70	1
SOA/HC 113P	Orchard Management	100	-	100	1
SOA/HC 114T	Principles of Plant Breeding	100	30	70	2
SOA/HC 114P	Principles of Plant Breeding	100	-	100	1
Skill Enhancement Compulsory Course (SEC)					
SOA/HSEC 101 T	Propagation and Nursery Management	100	30	70	1
SOA/HSEC 101 P	Propagation and Nursery Management	100	-	100	1
Elective					
Student has to earn 6 credits from the electives. Student can choose any elective from same department or other department of School of Agriculture & Allied Sciences.					
SOA/HE 109T	Fundamentals of Entomology & Nematology	100	30	70	1
SOA/HE 109P	Fundamentals of Entomology & Nematology	100	-	100	1
SOA/HE 110 T	Introduction to Major Field Crops	100	30	70	1
SOA/HE 110 P	Introduction to Major Field Crops	100	-	100	1
SOA/HE 111 T	Fundamentals of Plant Pathology	100	30	70	1
SOA/HE 111 P	Fundamentals of Plant Pathology	100	-	100	1
Total Credit to earn in the semester III					
Core	AECC	SEC	Elective	Total	
13	-	2	6	21	

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester IV					
Core					
SOA/HC 115 T	Spices and Condiments	100	30	70	1
SOA/HC 115 P	Spices and Condiments	100	-	100	1
SOA/HC 116 T	Temperate Fruits	100	30	70	2
SOA/HC 116P	Temperate Fruits	100	-	100	1
SOA/HC 117T	Ornamental Horticulture	100	30	70	2
SOA/HC 117P	Ornamental Horticulture	100	-	100	1
SOA/HC 118T	Water Management in Horticultural Crops	100	30	70	1
SOA/HC 118P	Water Management in Horticultural Crops	100	-	100	1
SOA/HC 119T	Plantation Crops	100	30	70	2
SOA/HC 119P	Plantation Crops	100	-	100	1
Skill Enhancement Compulsory Course (SEC)					
SOA/HSEC 102 T	Organic Farming	100	30	70	1
SOA/HSEC 102 P	Organic Farming	100	-	100	1
Elective					
Student has to earn 6 credits from the electives. Student can choose any elective from same department or other department of School of Agriculture & Allied Sciences.					
SOA/HE 112T	Breeding of Fruits and Plantation Crops	100	30	70	1
SOA/HE 112P	Breeding of Fruits and Plantation Crops	100	-	100	1
SOA/HE 113 T	Growth and Development of Horticultural Crops	100	30	70	1
SOA/HE 113 P	Growth and Development of Horticultural Crops	100	-	100	1
SOA/HE 114 T	Genetic Resources of Horticultural Crops	100	30	70	1
SOA/HE 114P	Genetic Resources of Horticultural Crops	100	-	100	1
Total Credit to earn in the semester IV					
Core	AECC	SEC	Elective		Total
13	-	2	6		21

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester V					
Core					
SOA/HC 120 T	Temperate Vegetables	100	30	70	2
SOA/HC 120 P	Temperate Vegetables	100	-	100	1
SOA/HC 121 T	Principles of Landscape Gardening	100	30	70	1
SOA/HC 121P	Principles of Landscape Gardening	100	-	100	1
SOA/HC 122T	Farm Power and Machinery	100	30	70	1
SOA/HC 122P	Farm Power and Machinery	100	-	100	1
SOA/HC 123T	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	100	30	70	2
SOA/HC 123P	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	100	-	100	1
SOA/HC 124T	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	100	30	70	2
SOA/HC 124P	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	100	-	100	1
Skill Enhancement Compulsory Course (SEC)					
SOA/HSEC 103 T	Communication Skills & Entrepreneurship Development	100	30	70	1
SOA/HSEC 103 P	Communication Skills & Entrepreneurship Development	100	-	100	1
Elective					
Student has to earn 6 credits from the electives. Student can choose any elective from same department or other department of School of Agriculture & Allied Sciences.					
SOA/HE 115T	Soil and Plant Analysis	100	30	70	1
SOA/HE 115P	Soil and Plant Analysis	100	-	100	1
SOA/HE 116 T	Mushroom Culture	100	30	70	1
SOA/HE 116 P	Mushroom Culture	100	-	100	1
SOA/HE 117 T	Fundamentals of Food Technology	100	30	70	1
SOA/HE 117P	Fundamentals of Food Technology	100	-	100	1
Total Credit to earn in the semester V					
Core	AECC	SEC	Elective	Total	
13	-	2	6	21	

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester VI					
Core					
SOA/HC 125 T	Potato and Tuber crops	100	30	70	1
SOA/HC 125 P	Potato and Tuber crops	100	-	100	1
SOA/HC 126 T	Breeding of Vegetable, Tuber and Spice Crops	100	30	70	2
SOA/HC 126P	Breeding of Vegetable, Tuber and Spice Crops	100	-	100	1
SOA/HC 127T	Post harvest Management of Horticultural Crops	100	30	70	2
SOA/HC 127P	Post harvest Management of Horticultural Crops	100	-	100	1
SOA/HC 128T	Seed production of Vegetable, tuber and Spice Crops	100	30	70	2
SOA/HC 128P	Seed production of Vegetable, tuber and Spice Crops	100	-	100	1
SOA/HC 129T	Insect Pests of Vegetable, Ornamental and Spice Crops	100	30	70	2
SOA/HC 129P	Insect Pests of Vegetable, Ornamental and Spice Crops	100	-	100	1
Skill Enhancement Compulsory Course (SEC)					
SOA/HSEC 104 T	Commercial Floriculture	100	30	70	1
SOA/HSEC 104 P	Commercial Floriculture	100	-	100	1
Elective					
Student has to earn 6 credits from the electives. Student can choose any elective from same department or other department of School of Agriculture & Allied Sciences.					
SOA/HE 118T	Breeding and Seed Production of Ornamental Plants	100	30	70	1
SOA/HE 118P	Breeding and Seed Production of Ornamental Plants	100	-	100	1
SOA/HE 119 T	Diseases of Vegetable, Ornamentals and Spice Crops	100	30	70	1
SOA/HE 119 P	Diseases of Vegetable, Ornamentals and Spice Crops	100	-	100	1
SOA/HE 120 T	Protected Horticulture	100	30	70	1
SOA/HE 120P	Protected Horticulture	100	-	100	1
Total Credit to earn in the semester VI					
Core	AECC	SEC	Elective	Total	
14	-	2	6	22	

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester VII					
Core					
SOA/HC 130 T	Processing of Horticultural Crops	100	30	70	2
SOA/HC 130 P	Processing of Horticultural Crops	100	-	100	1
SOA/HC 131 T	Protected Cultivation of High Value Horticultural Crops I. Project preparation	100	30	70	3
SOA/HC 132T	Nursery Production and Management I. Project preparation	100	30	70	3
Skill Enhancement Compulsory Course (SEC)					
SOA/HSEC 105 T	Horti-Business Management	100	30	70	2
Elective					
Student has to earn 6 credits from the electives. Student can choose any elective from same department or other department of School of Agriculture & Allied Sciences.					
SOA/HE 121P	Protected Cultivation of High Value Horticultural Crops II. Report writing, presentation and discussion.	100	-	100	6
SOA/HE 122P	Nursery Production and Management II. Report writing, presentation and discussion.	100	-	100	6
Total Credit to earn in the semester VII					
Core	AECC	SEC	Elective	Total	
09	-	2	6	17	

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

Course no.	Paper Title	Total marks	Theory marks		Credits
			Internal	External	
Semester VIII					
Core					
SOA/HC 132 T	Horticultural Work Experience(HWE) I. Project preparation	100	30	70	6
SOA/HC 133 P	Horticultural Work Experience(HWE) II. Field Work	100	-	100	6
SOA/HC 134 T	Horticultural Work Experience(HWE) III. Report writing, presentation and discussion	100	30	70	6
Total Credit to earn in the semester VIII					
Core	AECC	SEC	Elective	Total	
18	-	-	-	18	

Theory and practical are linked to each other.

In Theory, One credit = 1 hr

In practical, One credit= 3 hrs

T- Theory

P- Practical

Summary of credits:

Semester	Core	AECC	SEC	Elective	TOTAL
I	12	2	-	6	20
II	12	2	-	6	20
III	13	-	2	6	21
IV	13	-	2	6	21
V	13	-	2	6	21
VI	14	-	2	6	22
VII	09	-	2	6	17
VIII	18	-	-	-	18
TOTAL	104	4	10	42	160

Note: Practicals in affiliated colleges/ institute shall be conducted by the university appointed examiner.

Semester I

SOA/HC 101 T: Fundamentals of Geology and Soil Science (2)

Composition of earth's crust, soil as a natural body major components by volume pedology rocktypes Igneous sedimentary and metamorphic classification soil forming minerals. Definition classification – silicates, oxides, carbonates, sulphides, phosphates occurrence. Weathering of rocks and minerals, weathering factors: physical, chemical, biological agents involved, weathering indices, factors of soil formation, land forms parent, material climate organism, relief time soil forming processes eluviations and illuviation formation of various soils. Problem soils: salted soils, permeable, flooded, sandy soils properties. Physical parameters texture definition methods of textural analysis textural classes, absolute specific gravity definition apparent specific gravity/bulk density factors influencing field bulk density. Relation between BD, PD Practical Problem. Pore space definition, factors affecting capillary and noncapillary porosity, soil colour definition, its significance, colour variable hue, value, chroma, Munsell colour chart, factors influencing parent material soil moisture organic matter, soil structure, types of structure, factors influencing genesis of soil structure. Soil air air composition, amount of air space, soil air renewal, soil temperature sources and distribution of heat, chemical properties humus inorganic secondary silicate clay hydrous oxides. Soil organic matter decomposition, pH nutrient availability, soil buffering capacity, 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. Soil water movement, saturated and unsaturated infiltration and percolation. Soils of different eco-systems and their properties.

SOA/HC 101 P: Fundamentals of Geology and Soil Science (1)

Identification of rocks and minerals; Collection and preparation of soil samples; Soil analyses for moisture, colour, bulk density, organic matter, pH, EC; Textural analysis by hydrometer method; Study of soil profile I & II; Excursion tour for identification of rocks and minerals and profile studies; Practical introduction to Tensiometer, pressure plate and neutron probe etc.

SOA/HC 102 T: Elementary Plant Biochemistry and Biotechnology (2)

Biochemistry: Carbohydrates-occurrence and classification-structures of glucose, fructose, ribose, maltose, lactose, starch and cellulose, physical and chemical properties of carbohydrates-isomerism, optical activity, reducing property, reaction with acids and alkalis- osazone formation. Lipids classification- important fatty acids and triglycerides, essential fatty acids -rancidity of oils acids value, saponification value & iodine value -phospholipids- types and importance-plant pigments structure and function of chlorophyll and carotenoids-sterols-basic structure. Protein - classification - functional 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 reactions of proteins. Enzymes-classification and mechanism of action-factors affecting enzyme action-cofactors and coenzymes - vitamins and mineral as coenzymes/cofactors .Carbohydrate -metabolism of lipids - lipases and phospholipases-fatty acid oxidation. Biosynthesis of fatty acids, protein metabolism proteolytic enzyme.

Biotechnology: Structure and component of nucleic acids, replication, transcription and translation. Historical developments in bio-technology. Application of plant tissue culture in plant improvement Micropropagation: Principales and application in forestry trees and medicinal plants; meristem culture; plant cell and suspension cultures; organogenesis and regeneration in vitro and somaclonal variations; genetic engineering techniques; transgenic

plants with case studies of tree species to diseases, production of secondary metabolites; germplasm conservation; An introduction to bioinformatics, genomics and proteomics, biodegradation of forestry wastes through genetically engineered microbes.

SOA/HC 102 P: Elementary Plant Biochemistry and Biotechnology (1)

Preparation of standard solutions and reagents – carbohydrates – qualitative reactions, estimation of starch, reducing and non-reducing sugars-reactions of proteins and amino acids-estimation of proteins by Lowry method – determination of acid value, saponification value, iodine number of vegetable oils-vitamins-estimation of ascorbic acids paper and thin layer chromatography. Sterilization techniques; preparation of culture medium for establishment of explants of horticultural plants, multiplication of shoots, induction of roots; meristem culturing; callus cultures, induction of organogenesis;

SOA/HC 103 T: Principles of Plant Physiology (2)

Water relations in plants: role of water in plant metabolism, osmosis, imbibition, diffusion, water potential and its components, absorption of water, mechanisms of absorption, ascent of sap. Stomata, structure, distribution, classification, mechanisms of opening and closing of stomata, guttation, transpiration, factors affecting transpiration. Different types of stresses: water, heat and cold tolerance, mechanism of tolerance. Plant nutrition: essentiality, mechanism of absorption, role in plant metabolism, Photosynthesis, importance of photosynthesis, Structure and function of chloroplast, dark and light reactions, CO₂ fixation, C₃, C₄ and CAM, advantages of C₄ pathway, photorespiration and its implications. Factors affecting the photosynthesis. Respiration, glycolysis, TCA cycle and Electron transport chain, ATP synthesis and factors affecting the respiration. . Photohormones, physiological role in controlling plant process.

SOA/HC 103 P: Principles of Plant Physiology (1)

Measurement of water potential by different methods, Osmosis – demonstration, Plasmolysis – demonstration, Root pressure – demonstration, Transpiration rate, Studying the structure of stomata, studying the opening and closing of stomata, Demonstration of importance of light in photosynthesis, Separation of xanthophyll, Chlorophyll in plants, Studying the activity of catalase, Detection of phenols in plants, Studying the plant movements, Root initiation in cuttings.

SOA/HC 104 T: Statistics & Computer Application (2)

Basic concepts: Variable statistics, types and sources of data, classification and tabulation of data, construction of frequency distribution, tables, graphic representation of data, simple, multiple component and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve. Average and measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles and quadriles, for raw and grouped data. Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data.

Probability: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poisson and normal distributions. Correlation: Scatter diagram, correlation coefficient and its properties, regression, fitting of simple linear regression. Test of significance: Basic concepts, Test of equality of one mean, Chi-square test for application of attributes and test for goodness of fit. Computer application: Introduction to computers and personal computers, basic concepts, hardware and software, input and output devices, operating system, Windows, MS Office , MS word, MS Power point, MS Excel.

SOA/HC 104 P: Statistics & Computer Application (1)

Variables and source of data, Construction of frequency distribution table, Bar chart-simple, multiple, component and percentage bar charts, Pie chart, histogram, polygon, frequency curve. Mean, Median and mode for raw and grouped data, range, standard deviation, variance and coefficient of variation for raw and grouped data.

Probability and additive and multiplicative laws, normal distribution and properties. 't' test for independent test, chi-square test for contingency tables and theoretical ratios. Correlation and Linear regression.

MS Office- Word, Excel, Power Point.

SOA/HE 101 T: Introductory Economics (2)

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, consumer equilibrium. 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 – cost concepts. Law of supply – supply schedule and curve elasticities. Market equilibrium, distribution – theories of rent, wage, interest and profit. Price determination and forecasting under various market structures.

SOA/HE 102 T: Applied Mathematics (2)

General Concepts; Elementary ideas of complex number; Arithmetic and geometric progression.

Elementary idea of permutation and combinations; Binomial theorem for positive integral index, any index and their applications, addition and subtraction formulae; Elementary idea of probability theory. Basic trigonometry, Trigonometric A, B and C, D formulae. Inverse Trigonometric functions. Elementary differentiation and integration.

Introduction to matrices and determinants, special type of matrices, addition, subtraction and multiplication of matrices. Inverse of a matrix solution of system of linear equations using Cramer's rule and matrices method.

SOA/HE 103 T: Introductory Biology (1)

Introduction to the living world and classification of plant kingdom, binomial Nomenclature; characteristics of algae, fungi, bryophyte, pteridophyta; angiosperms and zymnosperms-structure and functions. Morphology and important modification of root, stem and leaf, inflorescence, flower and fruit, seed structure and germination; cytology and histology (plant cell and tissues, internal structure of dicot and monocot plants).

General classification of animal kingdom; characteristics of major groups of Non-chordata and chordata; cell structure and function- cell as unit of life, prokaryotes, eukaryotes, cell organelles; cell division- mitosis, meiosis; origin of life and an elementary knowledge of animal evolution; histology of gut, liver, kidney, ovary, testies and skeletal system of rabbit; physiology of digestion, respiration, circulation, excretion, coordination, endocrine and

reproductive system; economic importance of animals in Forestry/Agriculture.

SOA/HE 103 P: Introductory Biology (1)

Important characters of algae, fungi, bryophytes, pteridophytes and gymnosperms; morphology of flowering plants and their parts i.e. root, stem and leaf modification, inflorescence and flowers; internal morphology (anatomy) of root, stem and leaf of both dicot and monocots; study of some important specimens from protozoa to mammals; skeleton of rabbit; study of slides of gut, liver, kidney, ovary and testis of rabbit.

SOA/HE 104 T: Sericulture (1)

Importance and history of sericulture, future scope, mulberry cultivation geographical distribution, species and varieties, classification, climate, nursery and propagation, field preparation, planting methods, irrigation, manuring, pruning and training, insect pests and diseases and their management, types of silk worms, morphology and life cycle, rearing appliances and methods, maintenance of sericulture units, egg production techniques and post cocoon technology, pests and diseases of silk moth, properties of silk, uses. Economics of sericulture. Recent trends in sericulture. Biology and behaviour of lac insect, host plants, lac cultivation, manufacture of shellac and its uses.

SOA/HE 104 P: Sericulture (1)

Mulberry- morphology and cultivation; anatomy and biology of silk worm, rearing appliance and method of rearing, enemies and disease of silk worm, visit to a silk worm rearing and silk reeling unit, economics of sericulture.

SOA/HAECC 101 T: Structural Grammar and Spoken English (1)

Introduction to word classes; structure of the verb in English. Uses of tenses. Study of voice. Use 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. Words with silent letters and their pronunciations. The basic intonation patterns.

SOA/HAECC 101 P: Structural Grammar and Spoken English (1)

Exercises in word classes. Study of verb patterns. Use of tenses and voice. Exercises in the use of conjunctions and prepositions. Exercises in sentence patterns. Writing reports on topics relating to horticulture/forestry, using active and passive sentences. (i) conversations related to everyday situations, (ii) selection and practice of conversations for the study of the concept of stress, stress shift, silent letters in words and basic intonation patterns. Mostly focused on spoken and writing English skill development.

Semester II

SOA/HC 105 T: Introductory Microbiology (1)

History and Scope of Microbiology: The discovery of micro-organism, spontaneous generation, 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 eucaryotic cells. Prokaryotic cell structure and functions. Types of culture media and pre-culture techniques. Microbial growth in models of bacterial, yeast and mycelial growth curve. Measurement of bacterial growth. General properties of viruses and brief description of bacteriophages. General principle of

bacterial genetics, DNA as genetic material. Antibiosis, symbiosis, intramicrobial and extra-microbial association.

SOA/HC 105 P: Introductory Microbiology (1)

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, turbidometric estimation of microbial growth.

SOA/HC 106 T: Principles of Genetics and Cytogenetics (2)

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.

SOA/HC 106 P: Principles of Genetics and Cytogenetics (1)

Study of fixatives and stains; Preparation of slides showing various stages of mitosis; Preparation of slides showing various stages of meiosis; Testing the viability and germination of pollen grains; Solving the problems on monohybrid and dihybrid crosses; Estimation of linkages/ chromosome mapping. Problem solving on Mendalian principles.

SOA/HC 107 T: Apiculture (1)

Importance and history of apiculture, different species of bees, morphology, anatomy, colony organization and life cycle, bee-keeping equipment, social behaviour, reproduction, queen rearing, bee pasturage, seasonal management, economics of beekeeping. Bee enemies, diseases of bees, role of bees in increasing the productivity of horticultural crops in India economy, bee products and their uses. Recent trends in apiculture.

SOA/HC 107 P: Apiculture (1)

Acquaintance with honey bee species, morphology, structural adaptation, biology-castes-bee-keeping equipment, bee forage plants. Collection and preservation of bee flora, enemies and diseases of bees. Handling of bee colonies and manipulation for honey production.

SOA/HC 108 T: Medicinal and Aromatic Crops (2)

History, scope, opportunities and constraints in the cultivation and utilisation of medicinal and aromatic plants in India. Importance, origin, distribution, production, climatic and soil requirements, propagation and nursery techniques, planting and aftercare, training, Therapeutic and pharmaceutical uses and pruning, nutritional and water requirements, plant protection, harvesting, processing, and economics of under mentioned important medicinal and aromatic plants. Medicinal Plants : pepper, cardamom, clove, ginger, turmeric, betelvine, periwinkle, Rauvolfia, Dioscorea, isabgol, Ammi majus, belladonna, Cinchona, pyrethrum and other species relevant to local conditions.

Aromatic Plants : Citronella grass, khus grass, sweet flag (bach), lavender, geranium, patchouli, bursera, Mentha, muskdana (musk mallow), Ocimum and other species relevant to the local conditions. Endangered medicinal and aromatic plants of India and their conservation. Study of chemical composition of a few important medicinal and aromatic

plants, their extraction and use. Therapeutic and pharmaceutical uses of important species.

SOA/HC 108 P: Medicinal and Aromatic Crops (1)

Morphological description and identification of various medicinal plants. Collection of medicinal plants and plant parts from natural habitats. Survey and study of nursery techniques including training and pruning of medicinal plants. Harvesting, drying, grading, storage and processing techniques. Study of plant parts used in drug making. Visit to a nearby medicinal and aromatic plantation area /nursery /ayurvedic pharmacies /pharmaceutical industries.

SOA/HC 109 T: Soil Fertility and Nutrient Management (1)

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. Role of microorganisms in organic matter-decomposition – humus formation. Importance of C:N ratio and pH in plant nutrition. 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.

SOA/HC 109 P: Soil Fertility and Nutrient Management (1)

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.

SOA/HE 105 T: Fundamentals of Extension Education (1)

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry extension: process, principles and selected programmes of leading national and international forest institutes. People's participation in forestry programmes. Motivation of women community, children, youth and voluntary organizations for forestry 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. 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.

SOA/HE 105 P: Fundamentals of Extension Education (1)

Visits to study structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/Mahila Mandal, Village Panchayat, State Deptt. Of Forests/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.

SOA/HE 106 T: Fundamentals of Horticulture (1)

Economic importance and classification of horticultural crops and their culture and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery management practices, soil and climate, vegetable gardens, nutrition and kitchen garden and other types of gardens – principles, planning and layout, management of orchards, planting systems and planting densities. Production and practices for fruit, vegetable and floriculture crops, nursery techniques and their management. Principles and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water management, weed management, fertility management in horticultural crops, cropping systems, intercropping, multi-tier cropping, mulching, bearing habits, factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, principles of organic farming.

SOA/HE 106 P: Fundamentals of Horticulture (1)

Features of orchard, planning and layout of orchard, tools and implements, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits and vegetables, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

SOA/HE 107 T: Agrometeorology (1)

Agrometeorology-definition, aim and scope. Factors and elements of weather and climate. Composition and structure of atmosphere. Air and soil temperature regimes, atmospheric humidity, types of clouds and precipitation, hails and frost. Cyclones, anticyclones and thunderstorms. Solar radiations-components and effect on plant growth. Wind as a source of energy. Effect of weather and climate on the growth and development of crops. Climatic normals for crops. Agroclimatic zones of India and Himachal Pradesh. Evaporation and transpiration. Use of remote sensing techniques in agrometeorology. Agriculture weather forecasting.

SOA/HE 107 P: Agrometeorology (1)

Study of temperature instruments, pressure instruments, humidity instruments, wind instruments, rain instruments and wind rose. Solar radiation instruments with pyranometer. Monthly variation of rainfall at Nauni. Lay out of an agromet observatory and types. Measurement of wind and evaporation. Measurement of sunshine hours. Measurement of soil temperature and dew.

SOA/HE 108 T: Introductory Agroforestry (1)

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, hortisilvipastoral, 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*, *Dalbergia sissoo*, *Tectona*, *Populus*, *Morus*, *Grewia*, *Eucalyptus*, *Quercus* spp. and bamboo, tamarind, neem etc.)

SOA/HE 108 P: Introductory Agroforestry (1)

Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, *Grewia optiva*, *Morus alba*, *Acacia catechu*, *Dalbergia sissoo*, 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.

SOA/HAECC 102 T: Environmental Science (1)

Environment: introduction, definition and importance. Components of environment - interactions with organisms. Global and Indian environment - past and present status. Environmental pollution and pollutants. Air, water, food, soil, noise pollution - sources, causes and types. Smog, acid rain, global warming, ozone hole, eutrophication, sewage and hazardous waste management. Impact of different pollutions on humans, organisms and environment. Introduction to biological magnification of toxins. Deforestation - forms and causes, relation to environment. Prevention and control of pollution - technological and sociological measures and solutions - Indian and global efforts. India, international and voluntary agencies for environmental conservation - mandates and activities. International conferences, conventions and summits - major achievements. Environmental policy and legislation in India. Introduction to environmental impact assessment. Causes of environmental degradation - socio-economic factors. Human population growth and lifestyle.

SOA/HAECC 102 P: Environmental Science (1)

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.

Semester III**SOA/HC 110 T : Tropical and Sub-Tropical Fruits (2)**

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, bael, banana, grapes, citrus, papaya, sapota, guava, pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian 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. Rainfed horticulture, importance and scope of arid and semi-arid zones of India. Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.

SOA/HC 110 P: Tropical and Sub-Tropical Fruits (1)

Description and identification of varieties based on flower and fruit morphology in above crops. Training and pruning of grapes, mango, guava and citrus. 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 banana, grapes and mango. Seed production in papaya, latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits. Mapping of arid and semi-arid zones of India. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa, wood apple, West Indian cherry, tamarind, aonla, bael and annona.

SOA/HC 111 T: Weed Management in Horticultural Crops (1)

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: 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.

SOA/HC 111 P: Weed Management in Horticultural Crops (1)

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.

SOA/HC 112 T: Tropical and Sub-Tropical Vegetables (2)

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 and seed production. Economic of cultivation of tropical and sub-tropical vegetable crops; post-harvest handling and storage. Marketing of tomato, brinjal, chillies, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca and basella.

SOA/HC 112 P: Tropical and Sub-Tropical Vegetables (1)

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.

SOA/HC 113 T : Orchard Management (1)

Orchard management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches. Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems. Biological efficiency of cropping systems in horticulture, systems of irrigation. Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties. Integrated nutrient and pest management. Utilization of resources constraints in existing systems. Crop model and crop regulation in relation to cropping systems.

SOA/HC 113 P: Orchard Management (1)

Layout of different systems of orchard 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.

SOA/HC 114 T: Principles of Plant Breeding (2)

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. 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.

SOA/HC 114 P: Principles of Plant Breeding (1)

Breeding objectives and techniques in major field crop plants. Floral biology – its measurement, emasculation, crossing and selfing techniques in major crops. Determination of mode of reproduction in crop plants, handling of breeding material and maintenance of experimental records in self and cross pollinated crops. Demonstration of hybrid variation and production techniques.

SOA/HE 109 T: Fundamentals of Entomology & Nematology (1)

Introduction to phylum arthropoda. Importance of class Insecta. Insect dominance. Definition, division and scope of entomology. Comparative account of external morphonology-types of mouth parts, antennae, legs, wings and genetallia. Anatomy of digestive, excretory, nervous and reproductive systems. Postembryonic developmenteclosion. Matamorphosis. Types of larvae and pupa. Classification of insects upto orders and families of economic importance and their distinguished characters.

History of development of nematology- definition, economic importance. General characters of plant parasitic nematodes, their morphology, taxonomy and classification, biology, symptomatology and control of important plant parasitic nematodes of fruits- tropical, subtropical and temperate fruits, vegetables, tubers, ornamental and plantation crops. Role of nematodes in plant disease complex.

SOA/HE 109 P: Fundamentals of Entomology & Nematology (1)

Identification and collection of insects, symptoms of damages, application of insecticides; methods of sampling and extraction of nematodes from soil and plant parts, killing, fixing and separation of temporary and permanent nematode mounts. Nematicides and their use, parts damaged by plant parasitic nematodes.

SOA/HE 110 T: Introduction to Major Field Crops (1)

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.

SOA/HE 110 P: Introduction to Major Field Crops (1)

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

SOA/HE 111 T : Fundamentals of Plant Pathology (1)

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.

SOA/HE 111 P: Fundamentals of Plant Pathology (1)

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.

SOA/HSEC 101 T : Plant Propagation and Nursery Management (1)

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy (scarification & stratification) internal and external factors, nursery techniques, apomixes – mono-embryony, polyembryony, chimera & bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, nursery (tools and implements), use of growth regulators in seed and vegetative propagation, methods and techniques of cutting, layering, grafting 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. Micrografting, hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery.

SOA/HSEC 101 P : Plant Propagation and Nursery Management (1)

Media for propagation of plants in nursery beds, pot and mist chamber. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting. Hardening plants in the nursery. Practicing different types of cuttings, layering, graftings and buddings including opacity and grafting, etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labelling and packing of fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their maintenance. Top grafting, bridge grafting and nursery management. Nutrient and plant protection applications during nursery.

Semester IV

SOA/HC 115 T: Spices and Condiments (1)

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

SOA/HC 115 P: Spices and Condiments (1)

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.

SOA/HC 116 T: Temperate Fruits (2)

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, 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.

SOA/HC 116 P: Temperate Fruits (1)

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.

SOA/HC 117 T: Ornamental Horticulture (2)

History, scope of gardening, aesthetic values. Gardens in India, types of gardens. Landscaping, historical background, definition. Floriculture industry: importance, area and production, industrial importance in India. Landscaping, basic principles and basic components. Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents. Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds. Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens.

SOA/HC 117 P: Ornamental Horticulture (1)

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

SOA/HC 118 T: Water Management in Horticultural Crops (1)

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.

SOA/HC 118 P: Water Management in Horticultural Crops (1)

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.

SOA/HC 119 T: Plantation Crops (2)

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 and rubber.

SOA/HC 119 P: Plantation Crops (1)

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.

SOA/HE 112 T: Breeding of Fruit and Plantation Crops (1)

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 – policy manipulations – *in vitro* breeding tools (important fruit and plantation crops).

SOA/HE 112 P: Breeding of Fruit and Plantation Crops (1)

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.

SOA/HE 113 T: Growth and Development of Horticultural Crops (1)

Growth and development-definitions, components, photosynthetic productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, growth analysis in horticultural crops. Plant bioregulators- 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 nonclimacteric fruits.

SOA/HE 113 P: Growth and Development of Horticultural Crops (1)

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, rapid tissue test, seed dormancy, seed viability by tetrazolium test, seed germination and breaking seed dormancy with chemicals and growth regulators.

SOA/HE 114 T: Genetic Resources of Horticultural Crops (1)

Role of genetic resources- centres of origin and diversity of crops plants- law of homologous series-plant introduction and exchange of genetic resources- principles and concepts of plant quarantine- plant introduction in horticultural crops-germplasm collection and centres- gene bank- gene sanctuary- need for conservation- genetic erosion- germplasm exploration-germplasm conservation- in vitro conservation cryopreservation- DNA finger printing. Wild relatives and sources of resistance to biotic, abiotic stresses and quality characters for fruit, vegetable, flower and plantation crops, spices, medicinal plants. International institutes and organizations for germplasm- Trade Related Intellectual Property Rights (TRIPPS) and IPR for Indian cultivars.

SOA/HE 114 P : Genetic Resources of Horticultural Crops (1)

Morphological evaluation of germplasm, collections and identification of wild relatives for fruit crops, vegetable crops, flower crops; spices, plantation crops, medicinal and aromatic plants. One or two visits to the nearest germplasm centres.

SOA/HSEC 102 T: Organic Farming (1)

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.

SOA/HSEC 102 P: Organic Farming (1) Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, post harvest management.

Semester V

SOA/HC 120 T: Temperate Vegetables (2)

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, seed production, post-harvest technology. 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.

SOA/HC 120 P: Temperate Vegetables (1)

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.

SOA/HC 121 T: Principles of Landscape Gardening (1)

Landscaping: historical background, basic principles and components, landscape composition of hills and plains, identification and use of landscape drafting equipments, drawing and designing of home gardens, public parks, avenues, farm complexes and institutions. Layout of formal garden, informal garden, terrace garden, rock garden, bog garden, sunken garden, designing of conservatory and lathe house. Landscape design for specific areas.

SOA/HC 121 P: Principles of Landscape Gardening (1)

Principles and elements of landscape design, plant material for landscaping, symbols, tools and implements used in landscape design, layout of formal gardens, informal gardens, special type of gardens (bog garden, sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Landscape design for specific areas.

SOA/HC 122 T: Farm Power and Machinery (1)

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.

SOA/HC 122 P: Farm Power and Machinery (1)

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.

SOA/HC 123 T: Diseases of Fruits, Plantation and Medicinal and Aromatic Crops (2)

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.

SOA/HC 123 P: Diseases of Fruits, Plantation and Medicinal and Aromatic Crops (1)

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.

SOA/HC 124 T: Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops (2)

General–economic classification of insects; 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, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and Tephrosia.. Storage insects – distribution, host range, bioecology injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Toxicology – insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their tolerance limits.

SOA/HC 124 P: Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops (1)

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

SOA/HE 115 T : Soil and Plant Analysis (1)

Methods of soil and plant sampling and processing for analysis. Quantification of minerals and their abundance. Soil structure and aggregate analysis. Theories and concepts of soil moisture estimation – gravimetric, tensiometric, gypsum block, neutron probe and pressure methods. 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. Soil fertility evaluation methods. 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. Principles of working of pH meter, electrical conductivity meter, spectrophotometer, flame photometer and atomic absorption spectrophotometer. Quality of irrigation water.

SOA/HE 115 P: Soil and Plant Analysis (1)

Collection and preparation of soil and plant samples for analysis. Determination of water holding capacity and hydraulic conductivity of soil. Estimation of moisture content in soils and plants. Determination of pH, electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage of soils. Enumeration of soil microbes. Estimation of available macro and micronutrient elements in soils and their contents in plants. Irrigation water quality analysis.

SOA/HE 116 T: Mushroom Culture (1)

Introduction to mushrooms fungi – nutritional value, edible and poisonous types, edible mushrooms, *Pleurotus*, *Volvariella* and *Agaricus*, medicinal value of mushrooms, genetic improvement of mushroom, preparation of culture, mother spawn production, multiplication of spawn, cultivation techniques, harvesting, packing and storage; problems in cultivation – diseases, pest and nematodes – weed moulds and their management strategies. Economics of cultivation, post harvest technologies.

SOA/HE 116 P: Mushroom Culture (1)

Equipment and sterilization techniques for culture media, isolation of mother culture, and spawn preparation and maintenance of mushroom beds of oyster mushroom, *Volvariella* and *Agaricus*. Processing and preservations of mushrooms, economics of spawn and mushroom production and mushroom recipes

SOA/HE 117 T: Fundamentals of Food Technology (1)

Food and its function, physico-chemical properties of foods, food preparation techniques, nutrition, relation of nutrition of good health. Characteristics of well and malnourished population. Energy, definition, determination of energy requirements, food energy, total energy needs of the body. Carbohydrates: classification, properties, functions, source, requirements, digestion, absorption and utilization. Protein, classification, properties, functions, sources, requirements, digestion, absorption, essential and non-essential amino acids, quality of proteins, PER/NPR/NPU, supplementary value of proteins and deficiency. Lipids – classification, properties, functions, sources, requirements, digestion, absorption and utilization, saturated and unsaturated fatty acids, deficiency, rancidity, refining of fats. Mineral nutrition: macro and micro-minerals (Ca, Fe and P), function, utilization, requirements, sources, effects of deficiency. Vitamins: functions, sources, effects of deficiency, requirements of water soluble and fat-soluble vitamins. Balanced diet: recommended dietary allowances for various age groups, assessment of nutritional status of the population.

SOA/HE 117 P: Fundamentals of Food Technology (1)

Methods of measuring food ingredients, effect of cooking on volume and weight, determination of percentage of edible portion. Browning reactions of fruits and vegetables. Microscopic examination of starches, estimation of energy, value proteins and fats of foods. Planning diet for various age groups.

SOA/HSEC 103 T: Communication Skills and Entrepreneurship Development (1)

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. Overview of horti inputs industry. Characteristics of Indian horticultural processing and export industry. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

SOA/HSEC 103 P: Communication Skills and Entrepreneurship Development (1)

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations.

Semester VI

SOA/HC 125 T: Potato and Tuber Crops (1)

Origin, area, production economic importance and export potential of potato and tropical, subtropical and temperate tuber crops; description of varieties and hybrids. Climate and soil requirements, 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; seed production, economics of cultivation. Post harvest handling and storage, field and seed standards, marketing of the following crops:

Crops: potato, tapioca, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, jerusalem artichoke, horse radish and other under- exploited tuber crops.

SOA/HC 125 P: Potato and Tuber Crops (1)

Identification and description of potato and tropical, subtropical and temperate tuber crops; planting systems and practices; field preparation and sowing/planting. Topdressing of fertilizers and inter culture 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.

SOA/HC 126 T: Breeding of Vegetable, Tuber and Spice Crops (2)

Centres of origin, plant bio-diversity and its conservation. Models of reproduction, pollination systems and genetics of important vegetable, tuber and spice crops. Selfincompatibility and

male sterility, its classification and application in crop improvement. Principles of breeding self-pollinated crops, pure line selection, mass selection, heterosis breeding, hybridization, pedigree method, mass pedigree method, bulk method, modified bulk method, single seed descent method and back cross method. Polyploidy breeding.

Mutation breeding. Principles of breeding cross pollinated crops, mass selection, recurrent selection, heterosis breeding, synthetics and composites. Application of biotechnology in crop improvement. Crops: Solanaceous vegetables, cole crops, cucurbits, bulb crops, root crops, leafy vegetables, okra, leguminous crops.

SOA/HC 126 P: Breeding of Vegetable, Tuber and Spice Crops (1)

Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance. Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

SOA/HC 127 T: Post Harvest Management of Horticultural Crops (2)

Importance of post-harvest technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, medicinal and aromatic plants. Pre-harvest factors affecting quality, factors responsible for deterioration of horticultural produce, physiological and bio-chemical changes, hardening and delaying ripening process. Post-harvest treatments of horticultural crops. Quality parameters and specification. 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 precooling, 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.

SOA/HC 127 P: Post Harvest Management of Horticultural Crops (1)

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 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, packaging houses and cold storage units.

SOA/HC 128 T: Seed Production of Vegetable, Tuber and Spice Crops (2)

Introduction and history of seed industry in India. Definition 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. Methods of seed production of cole crops, root vegetables, solanaceous vegetables, cucurbits, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables. Seed germination and purity analysis. Field and seed standards. Seed drying and extraction. Seed legislation.

SOA/HC 128 P: Seed Production of Vegetable, Tuber and Spice Crops (1)

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 in cole crops, root vegetables, bulb crops, solanaceous vegetables, cucurbits, leafy vegetables, leguminous vegetables and exotic vegetables. Seed processing machines. Visit to seed production units.

SOA/HC 129 T: Insect Pests of Vegetable, Ornamental and Spice Crops (2)

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, bioecology, 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.

SOA/HC 129 P: Insect Pests of Vegetable, Ornamental and Spice Crops (1)

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.

SOA/HE 118 T: Breeding and Seed Production of Ornamental Plants (1)

History of improvements of ornamental plants, objectives and techniques in ornamental plant breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental plants. Breeding for disease resistance. Development of promising cultivars of important ornamentals. 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.

SOA/HE 118 P: Breeding and Seed Production of Ornamental Plants (1)

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

SOA/HE 119 T: Diseases of Vegetable, Ornamental and Spice Crops (1)

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, radish, knol-khol, pea, beans, beet root, onion, garlic, fenugreek, ginger, potato, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, cinnamon, jasmine, rose, crossandra, tuberose, geranium. Important post-harvest diseases of vegetables and ornamental crops and their management.

SOA/HE 119 P: Diseases of Vegetable, Ornamental and Spice Crops (1)

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

SOA/HE 120 T: Protected Horticulture (1)

Importance and scope, basic principles of protected cultivation. Green and polyhouse designs, green house environment control, heating and cooling system- use of portable tunnel. Green house cultivation of important horticultural crops- rose, carnation, gerbera, orchids, anthurium, tomato, bell, pepper and strawberry. Insect pest and disease management under protected cultivation.

SOA/HE 120 P: Protected Horticulture (1)

Study of green house design. Practice of protected cultivation of horticultural crops- rose carnation, Gerbera and orchids, anthurium, tomato, bell, pepper and strawberry.

SOA/HSEC 104 T: Commercial Floriculture (1)

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

SOA/HSEC 104 P: Commercial Floriculture (1)

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

Semester VII

SOA/HC 130 T: Processing of Horticultural Crops (2)

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.

SOA/HC 130 P: Processing of Horticultural Crops (1)

Equipment 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.

SOA/HC 131 T: Protected Cultivation of High Value Horticultural Crops (3)

Visit to commercial polyhouses, Project preparation and planning. Specialised lectures by commercial export house.

SOA/HC 132 T: Nursery Production and Management (3)

Project preparation

SOA/HE 121P: Protected Cultivation of High Value Horticultural Crops (6)

1. Study of designs of green- house structures for cultivation of crops
2. Land preparation and soil treatment
- 3.. Planting and production:
 - i. Cultural management including soil/media management in poly houses

- ii. Fertigation and irrigation management
 - iii. Integrated Pest Management
 - iv. Harvesting and post harvest management; certification and distribution
 - v. Cost of production
4. Visit to export houses; Market intelligence; Marketing of produce; cost analysis; Institutional management
 5. Report writing, presentation and discussion.

SOA/HE 122P: Nursery Production and Management (6)

1. .Nursery registration, methodology and certification
2. Establishment and management of plant propagating structures
3. Establishment of progeny blocks, identification of mother plants and maintenance of bud wood bank
4. Procurement of inputs (pots, polythene,FYM etc.)
5. Techniques and environ management for large scale production
6. Packaging and selling of plant material
7. Working out economics
8. Report writing, presentation and discussion

SOA/HSEC 105 T: Horti- Business Management (2)

Farm management - definition, nature, characteristics and scope. Farm management principles and decision making, production function, technical relationships, cost concepts, curves and functions – 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. 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.

Semester VIII

Horticultural Work Experience 18 (6+6+6)

The students will spend one full semester working with State Department of Horticulture; Horticulture based industries, commercial horticulture farms, plantation industries etc. to gain **first hand information and hands-on-training** in the chosen area of interest.

Horticultural work experience will be evaluated by the department committee on the basis of

SOA/HC 132 T : Project report preparation (6)

SOA/HC 133 P : Field Work (6)

SOA/HC 134 T Project report writing, Presentation and Discussion (6)