

B. SC. (Hort.) Hons. Syllabus of Faculty of Horticulture
Uttar Banga Krishi Viswavidyalaya

SEMESTERWISE COURSE DISTRIBUTION

FIRST TERM

Course no.	Title	Credit
SSC-101	Introduction to Soil Science	2+1
GPB-101	Crop Physiology	2+1
PPT-101	Fundamentals of Horticulture	2+1
PPT- 102	Plant propagation and Nursery management	1+1
EXT-101	Fundamentals of extension education	1+1
PCP-101	Growth and development of Horticulture crops	1+1
VSC-101	Tropical and subtropical Vegetables	2+1
AG-101	Communications skills in English	1+1
AG-102	Physical education	0+1
		12+9=21

SECOND TERM

Course no.	Title	Credit
AST-151	Fundamentals of Statistics	1+1
AST152	Elements of computer application	1+1
ENT-151	Plant parasitic nematode and their management	1+1
PPT-151	Tropical and subtropical fruits	2+1
PPT-152	Fundamentals of food technology	1+1
GPB-151	Principles of genetics and cytogenetics	2+1
PPA-152	Fundamentals of plant pathology	2+1
SSC-151	Introductory Microbiology	1+1
ECO-151	Introductory Economics	2+0
VSC-151	Water management in Hort. Crops	1+1
		14+9=23

THIRD TERM

Course no.	Title	Credit
PPT-201	Temperate fruits	1+1
FAM-201	Ornamental horticulture	2+1
AST-201	Fundamentals of statistics- II	1+1
BCH-201	Biochemistry	2+1
ENT-201	Fundamentals of Entomology	2+1
GPB-201	Principles of Plant breeding	2+1
VSC-201	Temperate Vegetables	1+1

Course no.	Title	Credit
VSC-202	Potato and tuber Crops	1+1
AEN-201	Farm power machinery and renewable energy	2+1
AG-201	National service scheme (NSS) (NC)	0+1
		14+10=24

FOURTH TERM

Course no.	Title	Credit
VSC-251	Spices and condiments	1+1
FAM-251	Commercial floriculture	2+1
PCP-251	Plantation crops	2+1
PPT-251	Orchard management	1+1
PPT-252	Breeding of fruits and Plantation crops	2+1
PPA-252	Mushroom culture	0+1
FOR-251	Environmental Science	2+1
ENT-251	Insect ecology and integrated pest management including beneficial insect	2+1
SSC-251	Soil science-I	2+1
		14+9=23

FIFTH TERM

Course no.	Title	Credit
AGR-302	Organic farming	1+1
AGR-303	Introduction of major field crops	1+1
FOR-301	Introductory Agroforestry	1+1
ENT-302	Apiculture	0+1
PPT-301	Post harvest management of horticultural crops	2+1
GPB-301	Principles of plant biotechnology	1+1
PPA-301	Disease of hort. Crops and their management-I	2+1
FAM-301	Breeding and seed production of ornamental plants	2+1
VSC-301	Breeding of vegetable, tuber and spice crops	2+1
		12+9=21

SIXTH TERM

Course no.	Title	Credit
SSC-352	Remote sensing, GPS and GIS	1+1
EXT-351	Entrepreneurship Development	1+1
VSC-351	Seed production of veg., tuber and spice crops	1+1
FAM-351	Medicinal and Aromatic plants	2+1

Course no.	Title	Credit
PCP-351	Processing of horticulture crops	1+2
ECO-352	Horti. Business management	2+0
ENT-351	Insect pest hort. Crops and their management	2+1
PPA-351	Disease of hort. Crops and their management	2+1
FAM-352	Principle of landscape gardening	0+1
AGR-352	Weed management	1+1
		13+10=23

SEVENTH TERM

Course no.	Title	Credit
EL-401	Experimental Learning	0+20

EIGHT TERM

Course no.	Title	Credit
RHWE	Rural horticultural work experience	0+10
IT	Industrial Training	0+10

DEPARTMENTWISE COURSE DISTRIBUTION

Department of Pomology and Post Harvest Technology

<i>Sl</i>	<i>Course</i>	<i>Name of the course</i>	<i>Credit</i>
1.	PPT 101	Fundamentals of Horticulture	2+1
2.	PPT 102	Plant Propagation & Nursery Management	1+1
3.	PPT 151	Tropical and Sub-tropical Fruits	2+1
4.	PPT 152	Fundamentals of Food Technology	1+1
5.	PPT 201	Temperate Fruits	1+1
6.	PPT 251	Orchard Management	1+1
7.	PPT 252	Breeding of Fruits & Plantation Crops	2+1
8.	PPT 301	Post Harvest Management of Horticultural Crops	2+1

1. PPT 101

Fundamentals of Horticulture

3(2+1)

Theory: 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.

Practical: 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.

2. 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 (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.

Practical: 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, labeling 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.

3. PPT 151**Tropical and Sub-Tropical Fruits****3(2+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, 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.

Practical: 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.

4. PPT 152

Fundamentals of Food Technology

2 (1+1)

Theory: 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.

Practical: 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.

5. PPT 201**Temperate Fruits****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, 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.

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.

6.PPT 251**Orchard Management****2(1+1)**

Theory: 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.

Practical: 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.

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

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.

8. PPT 301 Post Harvest Management of Horticultural Crops 3 (2+1)

Theory: 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 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.

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 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.

Department of Vegetable and Spice Crops

VSC- 101: Tropical and Sub-Tropical Vegetables 3(2+1)

VSC-151: Water Management in Horticultural Crops 2(1+1)

VSC- 251: Spices and Condiments 2(1+1)

VSC- 201: Temperate Vegetables 2(1+1)

VSC- 202: Potato and Tuber Crops 2(1+1)

VSC- 301: Breeding of Vegetable, Tuber and Spice Crops 3(2+1)

VSC- 351: Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

VSC- 101: Tropical and Sub-Tropical Vegetables 3(2+1)

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.

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-151: Water Management in Horticultural Crops 2(1+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.

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.

VSC- 201: Temperate Vegetables 2(1+1)

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.

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- 202: Potato and Tuber Crops 2(1+1)

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; seed production, economic of cultivation. Post-harvest handling and storage, field and seed standards, marketing. Crops to be covered – potato, tapioca, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, Jerusalem artichoke, horse radish and other under exploited tubercrops.

Practical: Identification and description of potato and tropical, sub-tropical and temperate tuber crops; planting systems and practices; field preparation and sowing/planting. Topdressing 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- 251: Spices and Condiments 2(1+1)

History, scope and importance, 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, ginger, turmeric, clove, nutmeg, cinnamon, all spice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishop's 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- 301: Breeding of Vegetable, Tuber and Spice Crops 3(2+1)

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

Practical: 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.

VSC- 351: Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

Theory: 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.

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 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.

Department of Floriculture, Medicinal and Aromatic Plants

FAM- 201: Ornamental Horticulture 3 (2+1)

FAM- 251: Commercial Floriculture 3(2+1)

FAM- 301: Breeding and Seed Production of Ornamental Crops 3(2+1)

FAM- 351: Medicinal and Aromatic Crops 3 (2+1)

FAM- 352: Principles of Landscape Gardening 1 (0+1)

FAM- 201: Ornamental Horticulture 3 (2+1)

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, planting, climbers and creepers, palms, ferns, grasses and cactisucculents. Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, rural country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for

playgrounds. Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens.

Practical: 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.

FAM- 251: Commercial Floriculture 3(2+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., 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- 301: Breeding and Seed Production of Ornamental Crops 3(2+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.

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

FAM- 351: Medicinal and Aromatic Crops 3 (2+1)

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. Medicinal Plants: Betelvine, periwinkle, Rauwolfia, Dioscorea, Isabgol, Ammimajus, Belladonna, Cinchona, Pyrethrum and other species relevant to local conditions. Aromatic Plants: Citronella grass, khus grass, flag(baje), lavender, geranium, patchouli, bursera, enthe, musk, Ocimum and other species relevant to the local conditions.

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 essential oils.

FAM- 352: Principles of Landscape Gardening 1 (0+1)

Practical: 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.

Department of Plantation Crops and Processing

PCP- 101: Growth and Development of Horticultural Crops 2(1+1)

PCP-251: Plantation Crops 3(2+1)

PCP- 351: Processing of Horticultural Crops 3 (1+2)

PCP- 101: Growth and Development of Horticultural Crops 2(1+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.

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

PCP-251: Plantation Crops 3(2+1)

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.

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- 351: Processing of Horticultural Crops 3 (1+2)

Importance and scope of fruit and vegetable preservation industry in India, food pipeline, 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: 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.

Department of Forestry

FOR- 251: Environmental Science 3 (2+1)

FOR-301: Introductory Agroforestry 2 (1+1)

FOR- 251: Environmental Science 3 (2+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.

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.

FOR-301: Introductory Agroforestry 2 (1+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, horti-silvipastoral, shifting cultivation, taungya, home gardens, alley cropping, intercropping, windbreaks, shelterbelts and energy plantations. Planning for agroforestry – constraints, diagnosis and design methodology, selection of tree crop species for agroforestry. 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.)

Practical: 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.

Department of Agronomy

AGR-301: Weed Management in Horticultural Crops 2 (1+1)

AGR-302: Organic Farming 2(1+1)

AGR-301: Weed Management in Horticultural Crops 2 (1+1)

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

AGR-302: Organic Farming 2(1+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.

Practical: 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.

Department of Genetics and Plant Breeding

GPB- 101: Crop Physiology 3(2+1)

GPB-151: Principles of Genetics and Cytogenetics 3 (2+1)

GPB- 201: Principles of Plant Breeding 3 (2+1)

GPB- 101: Crop Physiology 3(2+1)

Introduction - Definition of Crop Physiology - Importance in Agriculture and Horticulture. Morphological, physiological and biochemical changes during seed development, Seed Physiology - Physiological maturity - Morphological and physiological changes associated with physiological maturity in crop with examples -- Harvestable maturity - Utilization of seed reserves (carbohydrates, fats and proteins) during seed germination - Morphological, physiological and biochemical changes during seed germination - Factors affecting seed germination. Growth and Development - Definition - Types of growth - Determinate and Indeterminate growth - Monocarpic and Polycarpic species with examples Measurement of growth - Growth analysis Growth characteristics - Definitions and mathematical formulae. Crop Water Relations - Physiological importance of water to plants. - Water potential and its components, measurement of water status in plants. Transpiration - Definition - significance Transpiration in relation to Crop productivity - Water Use Efficiency - WUE in C₃, C₄ and CAM plants - Factors affecting WUE. Introduction to Photosynthesis. Photosynthesis - Energy synthesis - Significance of C₃, C₄ and CAM pathway- Relationship of Photosynthesis and crop productivity - Translocation of assimilates - Phloem loading, apoplastic and symplastic transport of assimilates. Source and sink concept - Photorespiration-Factors affecting Photosynthesis and productivity-Management of Photosynthesis for productivity- Methods of measuring photosynthesis - Photosynthetic efficiency - Dry matter partitioning-Harvest index of crops. Introduction to respiration.

Respiration and its significance - Importance of glycolysis, TCA cycle, Pentose Phosphate Pathway - Growth respiration and maintenance respiration, Alternate respiration - Salt respiration - wound respiration - measurement of respiration. Nutriophysiology - Definition - Mengel's classification of plant nutrients - Physiology of nutrient uptake-Foliar nutrition - Hydroponics - solution and sand culture. Control of flowering - Photoperiodism and Vernalisation in relation to crop productivity - Classification of plants - Commercial application of photoperiodism Plant Growth Regulators - Occurrence - Biosynthesis - Mode of action of Auxins, Gibberellins, Cytokinins, ABA, Ethylene. Novel plant growth regulators. Senescence and abscission- Definition - Classification - Theories of mechanism and control of senescence - Physiological and biochemical changes and their significance. Abscission and its relationship with senescence. PostHarvest Physiology. Fruit ripening - Metamorphic changes= Climacteric and non-climacteric fruits - Hormonal regulation of fruit ripening (with ethrel, CeC, Polaris, paclobutrazole) -Use of hormones in increasing vase life of flowers.

Practicals

Preparation of solutions. Growth analysis: Calculation of growth parameters. Methods of measuring water status in roots, stems and leaves. Measurement of water potential by Chardakov's method. Measurement of absorption spectrum of chloroplast pigments and fluorescence. Measurement of leaf area by various methods. Stomatal frequency and index. Leaf anatomy of C₃ and C₄ plants, Plant growth regulators and their effect on plant growth. Imbibition of seed. Optimum conditions for seed germination. Breaking seed dormancy : a. Chemical method b. Mechanical method; Yield analysis. Seed viability and vigour tests. Effect of ethylene on regulation of stomata

GPB-151: Principles of Genetics and Cytogenetics 3 (2+1)

Mendel's laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and difference between them; Multiple factor hypothesis; Cytoplasmic inheritance, its characteristics features and difference between chromosomal and cytoplasmic inheritance; Mutation and its characteristics features; Method of inducing mutation and C / B technique. Gene expression and differential gene activation; Lac operon and fine structure of gene; Ultra structure of cell and cell organelles and their functions; Study of chromosome structure, morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis, their significance and difference between them ; DNA and its structure, function, types, mode of replication and repair. RNA and its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis; Crossing over and factor affecting it; Mechanism of crossing over and cytological proof of crossing over; Linkage, Types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like Cotton, Wheat, Tobacco and Brassicas; Structural chromosomal aberrations.

Practical: Microscopy (Light microscope and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identifications of various stages of mitosis; Preparation of micro slides and identifications of various stages of meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modification; Trihybrid ratio; Chi-square analysis and Interaction of factors; Epistatic factors; Supplementary factors and duplicate factors; Complementary factors; Additive factors and Inhibitory factors; Linkage – Two point test cross; Linkage – Three point test cross; Induction of polyploidy using colchicines; Induction of chromosomal aberrations using chemicals.

GPB- 201: Principles of Plant Breeding 3 (2+1)

Floral biology, Emasculation and pollination techniques in cereals, millets, pulses, oil seeds, fibers, plantain crops etc. Aims and objectives of Plant Breeding; Modes of reproduction, sexual, asexual, apomixis and their classification; Significance in plant breeding; Modes of Pollination, genetic consequences, difference between self and cross pollinated crops; Methods of breeding – introduction and acclimatization. Selection, Mass selection Johansson's pure line theory, genetic basis, pure line selection; Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, Pedigree method, Bulk method, Back cross method and various modified methods; Incompatibility and male sterility and their utilization in crop improvement; Heterosis, Inbreeding depressions, Various theories of heterosis, exploitation of hybrid vigour development of inbreed lines, single cross and double cross hybrids; Population improvement programmes, recurrent selection, synthetics and composites; Methods of breeding for Vegetatively propagated crops; Clonal selection; Mutation breeding; Ploidy breeding; Wide hybridization, significance in crop improvement.

Practical: Botanical description and floral biology; Plant breeders kit; Hybridization techniques and precautions to be taken; Floral morphology, selfing, emasculation and crossing techniques; Study of male sterility and incompatibility in field plots; Rice, Maize and Wheat; and Sesamum; Redgram, and Greengram; Chillies, Brinjal and Tomato; Onion, Bottle gourd and Ridge gourd.

Department of Plant Pathology

PPA- 152: Fundamentals of Plant Pathology 3 (2+1)

PPA – 252: Mushroom Culture 1(0+1)

PPA – 301: Diseases Horticultural Crops and their management- I 3 (2+1)

PPA – 351: Diseases Horticultural Crops and their management- II 3 (2+1)

PPA- 152: Fundamentals of Plant Pathology 3 (2+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.

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 – 252: Mushroom Culture 1(0+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. 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

PPA – 301: Diseases Horticultural Crops and their management- I 3 (2+1)

Studies of symptoms, brief etiology, perpetuation, epidemiology and control of following diseases : **Citrus** : Canker, Tristeza, root rot; **Mango**: Malformation, Anthracnose, Black tip; **Banana** : Panama wilt, Sigatoka, Bunchy Top; **Grape**: Downy Mildew; **Pineapple** : fruit rot, Heart rot; **Papaya** : Papaya mosaic, Papaya ring spot, Papaya leaf curl; **Guava** : Guava wilt; **Apple** : Scab, fire blight; Damping off of Vegetables; **Chilli**: Anthracnose, leaf curl; **Bhindi**: YVMV; **Brinjal** : Wilt, Phomopsis blight, Sclerotinia foot rot, Little leaf of brinjal; **Potato** : Late blight, early blight, wilt, scab, wart, mosaic; **Tomato** : Late blight, early blight, leaf curl; **Beans**: Anthracnose; **Pea** : rust, powdery mildew; **Crucifers** : Downy mildew, club rot, black rot, Boron and Molybdenum deficiency; **Cucurbits**: Powdery mildew, downy mildew, anthracnose, mosaic; **Onion/garlic** : Stemphyllium blight, rust; **Coconut** : Bud rot, Ganoderma wilt; Beetvine : *Phytophthora* fruit and root rot; **Coffee** : Rust; **Tea** : Blister blight, Red rust, grey and brown blight; **Rose** : dieback, black spot; **Chrysanthemum** : Septoria leaf spot, Basal stem rots; **Ginger** : Rhizome rot; **Coriander** : Stem gall.

Practical: Field visit and acquaintance with disease of crops, study of pathogens where possible; important diseases are : Late blight of potato, Wilt of Tomato, Anthracnose of beans, powdery mildew of pea, Rhizome rot of Ginger, Stem gall of coriander, powdery mildew, Downy mildew of cucurbits, Stemphylium blight, Rust of onion and garlic; Dieback of rose. Acquaintance with common fungicides and their methods of application.

PPA – 351: Diseases Horticultural Crops and their management- II 3 (2+1)

Study of symptoms, brief etiology, epidemiology and control of following diseases : **Jasmine** : Leaf blight, Rust; **Marigold** : leaf spot and bud rot; **Tuberose** : foot and tuber rot, Blossom blight; **Gerbera** : Blossom blight, powdery mildew; **Gladiolus** : Corm rot, Flower rot; **Anthurium** : Anthracnose, bacterial blight; **Pomegranate**: Bacterial leaf spot, anthracnose; **Ber** : Powdery mildew; **Sapota** : Leaf spot; **jack fruit**: Rhizopus rot; **Pear**: Fire blight ; **Peach** : Leaf curl; **Almond** : Bacterial gummosis; **Walnut**: Dieback ; **Strawberry**: one important disease; **Cashew** : damping off, die back; **Rubber** : abnormal leaf fall, bark canker, stem rot; **Cocoa** : Black pod, stem canker, Vascular streak; **Fenugreek**: powdery mildew, downy mildew, rust; **Black pepper** : foot rot and quick wilt, anthracnose; **Cumin** : powder mildew, wilt; **Turmeric**: Rhizome rot, Leaf blotch; **Cardamom**: Katte, Capsule rot, chirke, foorke; **Nutmeg**: Fruit rot; **Clove**: Leaf spot and die back, Grey blight, **Senna**: Damping off; **Rauwolfia** : Cercospora leaf spot; **Pyrethrum** : Leaf blotch, grey mould; **Cinnamon** : leaf rot; **Belladonna**, **Ipecac**, **Stevia**, **Discoria** , **Mint** : Powdery mildew, Leaf spot; **Opium**: Downy mildew.

Practical:Field visit and acquaintance with diseases of crops, study of pathogens where possible; important diseases are: Leaf spot of Marigold, Blossom blight of tuberose, Corm rot Gladiolus, Rhizopus rot of jackfruit, anthracnose of black pepper.

Department of Agril. Entomology

ENT 151: Nematode Pests of Horticultural Crops and their Management 2 (1+1)

ENT- 201: Fundamentals of Entomology 3 (2+1)

ENT-302: Apiculture 1(0+1)

ENT 351: Insect pests of horticultural crops & their management 3(2+1)

ENT 151: Nematode Pests of Horticultural Crops and their Management 2 (1+1)

History of 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, subtropical and temperate) vegetables, tuber, ornamental, spice and plantation crops. Role of nematodes in plant disease complex.

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- 201: Fundamentals of Entomology 3 (2+1)

Entomology as a science- Importance of Entomology in Agriculture. History of Entomology in India. Positions of insect in animal kingdom; Dominance of insects. General organization of insect body wall- its structure and function- cuticular appendages and processes. Body regions (morphological features)- insect head- mouth parts, compound eye, antenna. Thorax- legs, wings- structure and functional modifications. Abdomen- structure, abdominal appendages including including external genitalia. Metamorphosis- post embryonic development; larvae, pupae types thereof. Classifications and nomenclature of insects- General characteristics of arthropods and insecta. Classification of insects as per Imms as revised by Richards and Davies. Salient taxonomic features of Orthoptera, Hemiptera, Thysanoptera, Coleoptera, Diptera, Hymenoptera, Lepidoptera, Isoptera and families thereof that is agriculturally important with example. Structure and functions of digestive, respiratory, excretory, circulatory, nervous and reproductive systems in insects. Mode of Reproduction.

Practical:

- Method of collection and preservation of insects including immature stages.
- External features of Grasshopper/Blister beetle
- Types of insect antennae, mouth parts and legs.
- Wing venation, types of wings and wing coupling apparatus.
- Types of insect larvae and pupae.
- Dissection of digestive system in insects.
- Dissection of male and female reproductive system in insect.
- Study of characters of orders Orthoptera, Dictyoptera, Neuroptera and Odonata.
- Study of characters of order isopteran, Thysanoptera, Hemiptera, Lepidoptera, Coleoptera, Hymenoptera, dipteral and their families.

ENT- 251: Insect ecology & integrated pest management including beneficial insects 3 (2+1)

Insect Ecology: Introduction, Ecosystem and its components. Effect of abiotic factors- temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors- food, competition, natural and environmental resistance. Biotic potential and environmental resistance. Population group properties. Causes for outbreak of pest in agro-ecosystem. Pest surveillance and pest forecasting. Categories of pests.

IPM: introduction, importance, concepts and tools of IPM- host plant resistance, cultural, mechanical, physical, Legislative, biological methods of control. Chemical control- importance, hazards and limitations. Classification of insecticides, toxicity of insecticidal and formulations of insecticides. Study of important insecticides. Cyclodiens, Organophosphates, Carbamates, Synthetic pyrethroids, Novel insecticides, Pheromones, Nicotinyl insecticides, Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic Lactones, Oxadiazimes, thiourea derivatives, Pyridine azomethines, Pyrroles, etc. Nematicides, Rodenticides, Acaricides and Fumigants. Botanical insecticides – neem based products, recent methods of pest control- repellents, antifeedants, hormones, attractant, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968-

Importance provisions. Application techniques of spray fluids. Phytotoxicity of insecticides: symptoms of poisoning, first aid antidotes.

Beneficial insects-parasites and predators used in pest control and their mass multiplication techniques. Important group of microorganism-bacteria, viruses and fungi used in pest control and their mass multiplication techniques.

Practical:

- Visits to meteorological observatory/automatic weather reporting station.
- Study of terrestrial and pond ecosystem of insects.
- Studies on behaviour of insect and orientation (repellency, stimulation, deterancy).
- Study of distribution pattern of insects, sampling techniques for the estimation of insect population and damage.
- Pest surveillance through light traps, pheromone traps and field incidence
- Practicable IPM practices-Mechanical and physical methods.
- Practicable IPM-Cultural and Biological methods.
- Chemical control-insecticides and their formulations
- Calculation of doses/concentration of insecticides.
- Compatibility of pesticides and phytotoxicity of insecticides
- IPM case studies
- Identification of common predators and their morphological characters
- Identification of common parasites and their morphological characters.

ENT-302: Apiculture 1(0+1)

Practical: 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. 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.

ENT 351: Insect pests of horticultural crops & their management 3(2+1)

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, croton, 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.

Economic importance of insects in vegetable, ornamental and spice crops -ecology and pestmanagement with reference to these crops. Pest surveillance in important vegetable,ornamental and spice crops. Distribution, host range, bio-ecology, injury, integratedmanagement 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 andornamental 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 of damage, collection, identification, preservation, assessment of damage and population of important insect – pests affecting fruits, plantation, medicinaland aromatic crops in field and storage.Study of symptoms, damage, collection, identification, preservation, assessment ofdamage/population of important insect-pests affecting vegetable, ornamental and spice cropsin field and during storage.

Department of Soil Science and Agril. Chemistry

SSC 101	Introductions to Soil Science	3(2+1)
SSC 152	Agricultural Microbiology	3(2+1)
SSC 251	Soil Science-I (Soil Chemistry, Soil Fertility and Fertilizer)	3(2+1)
SSC- 352	Remote Sensing and Geographical Information System for Natural Resource Management and Land Use Planning	3(1+2)

SSC 101 Introductions to Soil Science (2+1)

Pedological and Edaphologicalconcept:Definition of Pedology and Edaphology,Difference between Pedology and Edaphology,Definition of pedon, polypedon etc. Origin of the earth, Earth's crust:Solar system conceptEvolution of earth,Different spheres of the earth-concept, definition, composition, dimension etc.,Earth's crust, mantle and core- concept, definition, composition, dimension etc.Rocks and minerals-classification and composition:Definition of rocks and minerals, Monomineralanic and polymineralanic rocks-definition and examples, Definition of Petrography and Petrogenesis,Rock formation-factors,Classification of rocks – igneous rock- classification of igneous rock, Metamorphic rock and Sedimentary rock- definition, classification, examples ,Weathering of rocks and minerals, Weathering of rocks- definition, types of weathering- physical, chemical & biological weathering with example Parent materials and its classification: Definition, Secondary and primary minerals: description with examples Soil formation-factors and processes:Soil formation: Dockuchaiev, Jenny concept, soil forming factors: passive & active factors, age of soil ,Fundamental processes of soil formationDifferent process of soil formation like podzolization, laterization etc. Soil profile:,Definition of soil profile, horizon, different types of horizon with charactersSoil Texture – Soil separates (fine earth),

classification of soil separates, coarse or rock fragments, major characteristics of soil separates. Definition of Soil Texture, soil textural classes, alteration of soil textural classes, adjustment of land use to soil textural classes, heavy soils and light soils and their physical problems. Importance of soil texture, relation between soil texture and other soil properties. Soil Structure – Definition and classification of soil structure, difference between soil texture and soil structure, soil aggregation and aggregate formation. Important/agricultural significance of soil structure, management of soil structure. Soil Densities – Bulk density - Definition and factors affecting bulk density. Particle Density – Definition and factors affecting particle density, difference between bulk density and particle density. Pore space – Definition and factors affecting porosity of soil, relation between bulk density, particle density of soil, and total pore space of a soil, size of pores, factors affecting size of pores, void ratio, air filled porosity, fractional air content and other relation between various parameters related to density and porosity of soil. Numericals Soil colour - Definition, description, causes, importance/significance of soil colour, determination and interpretation of soil colour. Soil Water: Properties and Behaviour – Molecular structure of water and ice, density, surface tension, contact angle, capillarity, viscosity, vapour pressure, freezing and thawing, vaporization and condensation, heat capacity, dielectric constant of water, attraction of water to solids and to inorganic ions, water as a solvent. Importance of water in agriculture, behaviour of water in soil, Retention of soil water in the field, very brief ideas about soil water potential, soil moisture constants and factors affecting soil moisture constants. Soil water Classification – Physical classification along with the factors affecting various kinds of physical classification and biological classification, Available water - definition, concept and factors affecting available water. Numericals Soil Air – Composition of soil air, idea on soil aeration and gaseous exchange between soil and atmosphere, Importance of various components of soil air. Soil Temperature: Thermal properties of soil – Thermal concepts - heat, temperatures, latent heat, modes of transmission of heat, specific heat, thermal capacity, albedo, thermal conductivity and thermal diffusivity. Importance of soil temperature – effect on microbial activity, germination of seeds, root growth, crop growth and yields of crops. **Soil colloids**, properties, nature, type and significance. Layer silicate clays, their genesis and sources of charges. Structure of layer silicate clays (1:1, 2:1, 2:2 type), comparative properties of silicate clay minerals, genesis and sources of negative charges on silicate clay, organic soil colloids. Absorption of ions, concept of ion exchange phenomena, CEC, ECEC, AEC, factors affecting ion exchange, milliequivalent concept, percentage base saturation, Importance of cation exchange in plant nutrition, contact exchange, root CEC, complementary ion effect, pH and buffering, buffering capacity of soil, relation between pH-dependent and permanent charge. Characteristic and reclamation of acid soil: distribution of acid soils, concept of soil acidity, sources of soil acidity, kinds of soil acidity, problems of soil acidity, reclamation of acid soil, liming materials, calculation of CCE, chemical reactions between liming materials and acid soils, lime requirement (LR) and liming factor, effect of overliming, effects of lime on soil properties in relation to plant nutrition, acid sulphate soil. Characteristic

and reclamation of salt affected soil: Concept of salt affected soil (saline,alkali,blackalkali,salinealkali,degraded alkali or sodic),sources of soluble salts,characteristics of salt affected soils . Formation of salt affected soils(saline,alkali or sodic, saline-alkali),SAR,ESP, Reclamation of saline and alkali or sodic soils, Gypsum requirement (GR) ,Leaching Requirement(LR). Soil organic matter, composition and function, decomposability,factors affecting decomposition and humus formation, fractionation of soil organic matter, C:N and its significance,priming action

B) Practical class outline:

1. Collection and processing of soils,
2. Determination of soil pH by lovibond comparator and pH meter,
3. Determination of ECs of the given soil
4. Determination of B.D. and P.D.
5. Soil moisture determination,
6. Determination of Maximum water holding capacity,
7. Determination of soil texture by feel method,
8. Determination of Soil temperature,
9. Determination of Water quality analysis,
10. Identification of rocks and minerals.;
11. Analytical Chemistry- basic concepts, techniques & calculations.

SSC 152

Agricultural Microbiology

(2+1)

Introduction: Definition, scope and applied areas of microbiology; **History and Development of Microbiology:** The discovery of microorganisms, Spontaneous generation conflict, Germ theory of diseases, Role of microbes in fermentation, Development of soil microbiology; **Position of microorganisms in the living World:** Protista, Procaryotes and eukaryotes, Whattacker five kingdom classification ; **Microscopy and specimen preparation:** Bright field microscope, Simple and differential staining: smear preparation, fixation, mordant application etc.; **Procaryotic cell structure and function:** Structure and function of capsule, flagella, cell wall, cytoplasmic membrane, mesosome, cytoplasm, ribosome, reserved food materials etc.; **Growth of microorganisms:** Definition of growth, Bacterial, yeast and fungal growth curve, Synchronous growth of bacteria, Measurement of bacterial growth, **Nutrition and Culture media:** Classification of microorganisms based on nutrition, function of nutrients, nutrients required for microorganisms, classification of culture media, classification of microorganisms based on temperature and oxygen requirement.; **Bacterial metabolism:** ATP generation (substrate level phosphorylation, oxidative phosphorylation and chemiosmosis), ATP generation by heterotrophic bacteria (respiration and fermentation) and autotrophic bacteria (chemoautotrophy and photoautotrophy);

Bacteriophages : Properties and structure of bacterial viruses, Lytic and lysogenic cycles, viroids, prions.; **Soil Microbiology**: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, biological nitrogen fixation. Microflora of rhizosphere and phyllospheremicroflora, microbes in composting.;

Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial, Cyanobacterial and fungal), microbial insecticides, microbial agents for control of plant diseases, Biodegradation, Biogas production, Biodegradable plastics, plant- microbe interactions.

B) Practical class outline:

1. General instructions,
2. Familiarization with instruments,
3. materials, glassware etc. in a microbiology laboratory:
4. Practice of Aseptic methods: (i) Evaluation of aseptic technique with nutrient broth tubes.
5. Evaluation of aseptic technique with a nutrient agar plate,
6. Methods of sterilization and preparation of media: (i) Preparation of nutrient broth, nutrient agar plates, nutrient agar slants,
7. Sterilization of glassware by dry heating,
8. Sterilization of nutrient broth by Filtration.;
9. Plating methods for isolation and purification of bacteria :
10. Isolation of bacteria by streak plate method,
11. Checking of purity of a bacterial culture by streak plate method. - Morphological examination of bacteria by simple and differential staining;
12. Enumeration of bacteria: (i) Enumeration of bacteria by stain slide method. (ii) Enumeration of bacteria by pour plate method and spread plate method.

SSC 251 SoilScience-I (Soil Chemistry, Soil Fertility and Fertilizer)

(2+1)

Soil as a source of plant nutrients, essential and beneficial elements, criteria of essentiality, forms of nutrients in soil on exchange and fixation of nutrients(N,P,K) in soils, factors affecting fixation of nutrients, agricultural significance, Mechanism of nutrient transport to plants.;

Macronutrients(N,P,K,Ca,Mg,S) – occurrence, sources, forms, transformation and availability in soil and plant nutrition, function in plants, problems on availability in soil and plants and corrective measures.;

Micronutrients(Fe,Mn,Cu,Zn,Mo,B) – sources, forms in soils, functions in plants, factors influencing availability in soil and its management, nutrient transformation under submerged soils.;

Soil Fertility- different approaches for soil fertility evaluation-chemical and biological. Plant analysis-DRIS method, critical level in plants, rapid tissue tests, indicator plants.;

Manures: definition, difference from fertilizers, Classification of manures with examples (Bulky, concentrated, bio-fertilizers etc.), Characteristics of manures, FYM- definition, characteristics

,Composition of FYM,Factors determining quality of manures ,Loss of nutrients from FYM- reasons ,Improved method of handling FYM- trench method , Bio-gas compost plant ,Compost: definition, composition ,Classification of compost: rural/urban, aerobic/anaerobic Common composting methods: Indore method, Bangalore method,Enriched Compost: enrichment with N, P, K, bioinoculants, Sewage-sludge- sewage treatment, Plant and animal refuges: use as a organic manures, decomposition, mineralization, immobilization processes, C/N, C/P, C/S ratios- significance ,Vermicompost: Definition, classification, vermicasts, Green manures: Definition, classification Concentrated organic manures: definition, classification, composition etc. ,Fertilizers: Definition, Classification ,Nitrogenous fertilizers classification: important manufacturing processes Nitrogenous fertilizers classification: important manufacturing processes,properties of nitrogenous fertilizers 1L Manufacturing methods and preparation of important phosphatic fertilizers like SSP, DAP, MAP, Nitro-phosphates etc.,Properties and classification of potassic fertilize. Fate of individual nitrogenous fertilizers in soil: reactions in acid, neutral and alkaline soil, plant uptake, leaching, precipitation, fixation, adsorption, mineralization etc, Fate of individual phosphatic and potassic fertilizers in soil: reactions in acid, neutral and alkaline soil, plant uptake, leaching, precipitation, fixation, adsorption, mineralization etc. Secondary and micronutrient fertilizers: Names and composition 1L

B) Practical class outline:

1. Determination of Soil organic carbon,
2. Determination of soil pH by pH meter,
3. Estimation of available N in soil and plant extract
4. Estimation of available P in soil and plant extract
5. Estimation of available K in soil and plant extract
6. Estimation of available S in soil and plant extract
7. Estimation of available Ca and Mg in soil and plant extract
8. Estimation of total N and P in manures and compost.
9. Rapid test of ammoniacal & nitrate nitrogen for nitrogenous fertilizer, water soluble P_2O_5 for phosphatic, K for potassic fertilizers,
10. Determination of COD in organic wastes ,
11. To check the adulteration in fertilizers.

SSC- 352 Remote Sensing and Geographical Information System for Natural Resource Management and Land Use Planning 3(1+2)

Remote Sensing: Introduction to remote sensing and aerial photography; Definition and principles of remote sensing; Energy sources and radiation principles; Nature of electromagnetic and thermal radiations; Active and passive remote sensing systems; Propagation of radiations through the atmosphere; Atmospheric window; Types of remote sensors and scanners; Satellite data products; Spatial, temporal, spectral, and radiometric resolutions; Spectral signature of different earth features; Remote sensing in optical infrared region for study of vegetation, soil, and water; Crop stress detection and crop yield

modeling; Vegetation indices. Background and history of Indian space programme; Satellite imageries; Digital image processing: Image pre-processing, image processing, and image transformation; Image interpretation: True colour, Pseudo colour, and False colour compositions; Image classification: Supervised and unsupervised classifications. Global Positioning System (GPS): Introduction and applications of GPS navigation techniques; GPS satellites; Segments of GPS systems; Principles of GPS navigation; GPS broadcast signals; Accuracy of GPS systems; Sources of error in GPS; Error corrections; Pseudo range and differential GPS systems. Geographic Information System (GIS): Definition and objectives; Components of GIS; Types of data: Geographic and attribute data; Data structures in GIS: vector and raster based data models; Analysis tools in GIS: Buffer analysis, overlay analysis, and network analysis. Natural Resource Management and Land Use Planning: Objectives, methods, and interpretation of land use planning; Applications of geoinformatics for natural resource management and land use planning.

Practical:

Familiarization with remote sensing and GIS equipments, softwares (ERDAS Imagine/Geomatica/ENVI; IDRISI/Arc Info/Arc View/Arc GIS), and data products; Topographic sheets; Creation of data files in a geographic database system; Onscreen digitization technique; Map projections; Image interpretation and enhancement techniques; Supervised and unsupervised classifications; Distance and area measurement; Soil survey and interpretation of satellite imageries, topographic sheets, and reports towards natural resource management and land use planning.

Department of Agril. Engineering

AEN- 201: Farm Power, Machinery and Renewable Energy 3 (2+1)

AEN- 201: Farm Power, Machinery and Renewable Energy 3 (2+1)

Farm power in India: sources, I.C engines, working principles, two- stroke and four stroke engines, I.C. engine terminology, different systems of I.C. engine. Tractors, Types, Selection of tractor and cost of tractor power. Tillage implements: Primary and secondary tillage implements, Implements for inter-cultural operations, seed drills, paddy transplanters, plant protection equipment and harvesting equipment; Energy sources, Introduction, Classification, Energy from Biomass, Types of biogas plants, Biogas production and its utilization, Agricultural wastes, Principles of combustion, pyrolysis and gasification, Types of gasifiers, Producer gas and its utilization. Briquettes, Types of Briquetting machines, uses of Briquettes, Shredders. Solar energy, Solar air heaters, Solar space heating and cooling, Solar energy applications/Solar energy gadgets, Solar cookers, Solar water heating systems, solar grain dryers, Solar photo voltaic systems, solar lantern, Solar street lights, Solar pumping systems. Wind energy, Types of wind mills. Liquid Bio fuels, Bio diesel and Ethanol from agricultural produce, uses.

Practical: Study of different components of I.C. Engine; Study of working of four stroke

engine; Study of working of two stroke engine; Study of M.B. plough, measurement of plough size, different parts, horizontal and vertical suction, determination of line of pull etc.; Study of disc plough; Study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; Study, maintenance and operation of tractor; Learning of tractor driving; Study, maintenance and operation of power tiller; Study of different parts, registration alignment and operation of mower. Study of different inter cultivation equipments in terms of efficiency, field capacity; Repairs and adjustments and operation of sprayers; Repairs and adjustments and operation of clusters; Study of paddy transplanters. Constructional details of KVIC & Janatha type biogas plants; Constructional details of Deen Bandu type biogas plants; Field visit to biogas plants; Briquette preparation from biomass; To study and find the efficiency of solar cooker; To study and find the performance of a solar still; Study and performance evaluation of domestic solar water heater; Study and performance evaluation of solar lantern; Field visit to wind mills; To study the processing of Bio- diesel production from jatropha.

Department of Agril. Statistics

AST- 151: Fundamental of Statistics (2+ 1)

AST- 152: Elements of Computer Application 2 (1+1)

AST- 201: Fundamentals of Statistics- II 2 (1+1)

AST- 151: Fundamental of Statistics (2+ 1)

Concept of Statistics; Frequency Distribution of Ungrouped and Grouped data; Measures of Central Tendency: AM, GM, HM, Median, Mode, Quartiles, Percentiles; Measures of Dispersion: Range, Mean Deviation, Standard Deviation, Coefficient of variation, Coefficient of Mean Deviation, Coefficient of Quartile Deviation; Moments, Skewness, Kurtosis.

Elementary set Theory; theory of Probability: Probability: Definitions (Class, Axiomatic) of Probability; Theorem on Total and Compound Probability (For two events only with proof), Pair wise and Mutual Independence of Events; Random variable. Probability Mass Function and Probability Density Function Expectation and Variance; Theoretical Distributions: Binomial Distribution, Poisson Distribution and Normal Distribution; Central Limit Theorem (Statement only). Statistical Methods: Simple Correlation and Regression.

Practical : Construction of frequency distribution from ungrouped data; Calculation of different measures of Location and Dispersion and the measures of Skewness and Kurtosis. Calculation of simple correlation coefficient; Method of prediction through fitting of linear regression equations; fitting of binomial distribution, Poisson distribution and normal distribution.

AST- 152: Elements of Computer Application 2 (1+1)

Definition and characteristics of Computer. Organization of Computer. Computer generations, classifications of computers, data representation in computer, logic gates, Adder circuit, flip flops, Binary addition and subtraction, input/output units, Computer memory and permanent storage devices. Types of computer softwares, programming languages, flow charts, BASIC and FORTRAN programming, Introduction to internet.

Practical : DOS, MS-WORD, MS-EXEL, MS- POWERPOINT, MS-ACCESS, BASIC.

AST- 201: Fundamentals of Statistics- II 2 (1+1)

Sample survey: Basic concept and preliminaries of sampling theory; Advantages of sample survey over census-survey; Random Sampling (SRS), SRSWR and SRSWOR; Estimates of population Mean; Total and their variances (formulae only) for SRS; Concepts of sampling Errors and non-sampling errors.

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; t, χ^2 and F statistics. Design of experiment: concept and different terms of experimental designs; Fundamental principles, Uniformity trial, fertility contour map; Analysis of Variance one way and two way classified data (Equal observation / cell); Layout and Analysis of CRD, RBD and LSD.

Practical: Drawing of random samples using SRSWOR a destination of mean, Total and their standard errors and confidence intervals. Application of T, t, χ^2 and F statistics for test of significance in different statistical problems.

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

Department of Biochemistry

BCH- 201: Biochemistry 3(2+1)

BCH- 201: Biochemistry 3(2+1)

Biochemistry - Introduction and importance. Biomolecules - Structure, properties & applications: Carbohydrates (occurrence, classification, structure, optical isomerism and optical activity, physical and chemical properties - reducing property, reactions with acids and alkalis, osazone formation). Amino acids, peptides and proteins (classification and structure essential amino acids, properties of amino acids, colour reactions, amphoteric nature isomerism, structure of proteins - primary, secondary, tertiary and quaternary; properties and reactions of proteins). Enzymes (classification and mechanism of action, factors affecting enzyme action, vitamins and minerals as co-factor and coenzymes). Nucleotides and Nucleic acids (Structure and functions). Lipids (classification, Important fatty acids and triglycerides, essential fatty acids, physical and chemical properties of oils, their rancidity, phospholipids, types and importance). Plant pigments - structure and function of chlorophyll and carotenoids, sterols, basic structure, role of brassinosterols in plants. Metabolism- glycolysis, citric acid cycle, oxidative phosphorylation, bioenergetics of glucose; fatty acid oxidation, bioenergetics of fatty acids and lipid biosynthesis; protein synthesis - replication, transcription and translation.

Practical:

Models of sugars, sucrose and starch (atomic and paper), amino acids models (atomic) and paper model of protein, fatty acid model. Preparation of standard solutions and reagents. Carbohydrates- qualitative reactions, estimation of starch, reducing and non reducing sugars, quantitative determination of sugars after removal of interfering substances, paper chromatography for the separation of sugars. Protein denaturation- heat, pH, precipitation of proteins with heavy metals, immune reaction, reaction of proteins, protein estimation by Lowry method. Enzyme kinetics, competitive inhibition, enzyme immobilization, enzyme

induction. Extraction of nucleic acids, column chromatography of RNA hydrolysate. Characterization of lipids by T.L.C., extraction of oils from oilseeds, estimation of free fatty acids, determination of iodine number of vegetable oils, estimation of fatty acids by G.C. paper electrophoresis for the separation of plant pigments. Determination of phenols, estimation of ascorbic acid. Paper and thin layer chromatography. Industrial visits.

Department of Agril. Economics

ECO- 151: Introductory Economics 2(2+0)

ECO- 352: Horti- Business Management 2 (2+0)

ECO- 151: Introductory Economics 2(2+0)

Nature and scope of economics, definition and concepts, divisions of economics, economics 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, Engel'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 of 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.

ECO- 352: Horti- Business Management 2 (2+0)

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 – operation 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 ratios, capital budgeting. Project management – project preparation evaluation measures.

EXT- 101: Fundamentals of Extension Education 2(1+1)

EXT – 351: Entrepreneurship Development 2 (1+1)

EXT- 101: Fundamentals of Extension Education 2(1+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.

Practical: Visits to study structure, functions, linkages and extension programmes of ICAR 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 production plan.

EXT – 351: Entrepreneurship Development 2 (1+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 horticulture 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, precis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical: 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, precis writing, summarizing, abstracting; individual and group presentations.

Other Courses

AG 101: Communication Skills in English (NC) 2 (1+1)

Structural 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. 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.

AG 102: Physical Education (NC) 1(0+1)

NSS: orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness, highlight of consumer act. Environment enrichment and conservation, health. Family welfare and nutrition. NCC: introduction to NCC, defence services, system of NCC training, foot drill, sizing, forming up in three rank, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training- rifle bayonet, light machine gun, sten machine carbine, introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging, fire discipline and fire control order, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defence, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership and NCC song. Physical education: introduction to physical education. Posture, exercise for good posture, physical fitness exercise for agility, strength, coordination, endurance and speed. Rules and regulation of important games, skill development in any one of the game- football, hockey, cricket, volleyball, ball badminton,

throw ball, tennikoit. Participation in one of the indoor game – shuttle badminton, chess and table tennis. Rules and regulation of athletic events, participation in any one of the athletic event –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-to-day activities. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and game for leisure time, use and experience. Note: warming up and conditioning exercises are compulsory before the commencement of each class.

EL-401: Experiential Learning (EL)20(0+20)

Under this programme, the students will undergo hands on training based on the concept of “earn while you learn” adopting an end to end approach (production to marketing).

The students will choose one programme out of the following two programmes (Modules):

1. Commercial Horticulture
2. Protected cultivation of high value Horticultural crops

Rural Horticultural Work Experience (RAWE)

10(0+10)

Under RAWE, students will be required to stay in the villages along with the farmers to have a deeper insight in to the rural life and will study the village profile i.e. literacy, nutritional habits, socio-economic status, status and potential of Horticulture, Technological gaps, various developmental schemes run by the government and NGOs working in that area etc. The students will maintain the daily work sheet to be evaluated weekly by evaluation committee in consultation with the local bodies.

Industrial training (IT)

10 (0+10)

The students will be attached with the related industry (ies) where they will work under the real life situations. This will give them opportunity to critically examine the weaknesses and gaps in their chosen programmes. The progress of the students will be monitored and evaluated jointly by the representatives of the concerned industry and the committee constituted for this purpose by the University in the weightage of 75:25.