**Annexure-I**

# Courses and Syllabus for B.Sc. (Hort.) Degree Programme

## As per Fifth Deans Committee Recommendations

# I. DEPARTMENT OF FRUIT SCIENCE

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | FSC 101 | Fundamentals of Horticulture | 3(2+1) |
| 2 | FSC 102 | Plant Propagation and Nursery Management | 2 (1+1) |
| 3 | FSC 201 | Tropical and Sub Tropical Fruits | 3 (2+1) |
| 4 | FSC 202 | Temperate Fruit Crops | 2 (2+0) |
| 5 | FSC 301 | Dryland Horticulture | 2(1+1) |
| 6 | FSC 302 | Breeding of Fruit Crops | 2 (1+1) |
| | | **Total** | **14(9+5)** |

**FSC 101 Fundamentals of Horticulture 3(2+1)**

**Theory:**

Scope and importance, classification of horticultural crops and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery techniques and their management, 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 crops. Principles, objectives, types and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water management– irrigation methods, merits and demerits, weed management, fertility management in horticultural crops-manures and fertilizers, different methods of application, cropping systems, intercropping, multi-tier cropping, mulching– objectives, types merits and demerits. Classification of bearing habits of fruit trees, factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, principles of organic farming, market chain management.

**Practical**

Features of orchard, planning and layout of orchard, tools and implements, identification of various horticultural crops, 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 disorders in fruits, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

**FSC 102 Plant Propagation and Nursery Management 2 (1+1)**

**Theory**

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy, types of dormancy (scarification & stratification) internal and external factors, nursery techniques, nursery management, apomixes – mono-embrony, polyembrony, chimera& bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery (tools and implements), use of growth regulators in seed, types and stages of seed germination with examples and vegetative propagation, methods and techniques of division-stolons, pseudobulbs, offsets, runners, cutting, layering, grafting, formation of graft union, factors affecting, healing of graftage and budding physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud

union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers. Micrografting, meristem culture, callus culture, anther culture, organogenesis, somaclonal variation, hardening of plants in nurseries.Nursery registration act.Insect/pest/disease control in nursery and cost of establishment of propagation structures.

**Practical**

Media for propagation of plants in nursery beds, potting and repotting.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 grafting, top grafting and bridge grafting etc. Use of mist chamber in propagation and hardening of plants.Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labelling and packing of nursery 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. Nutrient and plant protection applications during nursery and study of micropropagation.Visit to public and private nurseries.

**FSC 201 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, use of rootstocks, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards.Physiological disorders.Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops.Mango, banana, grapes, citrus, papaya, sapota, guava, pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian, rambutan, bilimbi, loquat, roseapple, breadfruit and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and konkan 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, economics of production.Preparation of project proposal.

**Practical**

Description and identification of varieties based on flower and fruit morphology in fruit 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-fertilizers in fruit crops, preparation and application of growth regulators in banana, grapes and mango. Latex extraction and preparation of crude papain.Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits.Botanical description and identification of crops.Visit to public and private orchards.

**FSC 202 Temperate Fruit Crops 2(2+0)**

**Theory**

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

**FSC 301 Dryland Horticulture 2(1+1)**

**Theory**

Definition, importance and limitation of dry land horticulture, present status and future scope. Constraints encounter in dry lands. Agro-climatic features in rain shadow areas, scarse water resources, high temperature, soil erosion, run-off losses etc.

Techniques and management of dry land horticulture, watershed development, soil and water conservation methods-terraces, contour bunds,*etc*. Methods of control and impounding of run-off water-farm ponds, trenches, macro catch pits,etc.,*in-situ* water harvesting methods, micro catchment, different types of tree basins etc. Methods of reducing evapotranspiration, use of shelter belts, mulches, antitranspirants, growth regulators, etc. water use efficiency-need based, economic and conjunctive use of water, micro systems of irrigation etc.IFS concept and alternate land use systems.

Selection of plants having drought resistance.Special techniques, planting and after care-use of seedling races, root stocks, *in-situ* grafting, deep pitting/planting, canopy management etc.

Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.

**Practical**

Study of rainfall patterns.Water budgeting, contour bunding/ trenching, micro catchments, soil erosion and its control.Study of evapotranspiration, mulches, life savingirrigation.Special techniques of planting and aftercare in dry lands. Study of morphological and anatomical features of drought tolerant fruit crops. Mapping of arid and semi arid zones of India.Life savingirrigation.Visit to public institutes involved in dryland horticulture.

**FSC 302 Breeding of Fruit Crops 2 (1+1)**

**Theory**

Importance of breeding of fruit crops, problems in fruit trees. Origin, centres of diversity and distribution of fruit species. History, hybridization and developments in fruit crops.Introduction, selection, identification and selection of mutants, bud sports, chimeras and their perpetuation by vegetative propagation.Variability for economic traits, breeding strategies.Collection and maintenance of germplasm of varieties and related species.Breeding behaviour of fruit crops. Floral biology, pollination, incompatibility in mango, banana, citrus, papaya, pineapple, sapota, grapes, guava,pomegranate, apple, nuts etc. Prospects of genetic engineering and biotechnology in improvement of fruit crops

**Practical :**

Description and classification of related species and varieties of fruit crops.Study of floral structures, biology and economic produce of crops.Selfing and crossing techniques, use of mutagens, handling of breeding population, preparation of plant descriptors for important fruit crops. Visit to research centers and commercial orchard.

## II. DEPARTMENT OF VEGETABLE SCIENCE

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | VSC 102 | Tropical and Sub Tropical Vegetables | 3 (2+1) |
| 2 | VSC 201 | Temperate Vegetables and Tuber Crops | 3 (2+1) |
| 3 | VSC 202 | Precision Farming and Protected Cultivation of Vegetables | 1 (0+1) |
| 4 | VSC 301 | Breeding and Seed Production of Vegetable Crops | 3 (2+1) |
| 5 | VSC 302 | Experimental Techniques in Horticulture | 1 (0+1) |
| | | **Total** | **11(6+5)** |

**VSC 102 Tropical and Sub Tropical Vegetables 3 (2+1)**

**Theory**

Importance, scope and classification of vegetable crops. Area, production, origin, economic importance and export potentials, varieties/hybrids, climate and soil requirement, seed rate, modern nursery practices, field preparation, transplanting/sowing, spacing, water, weed, nutrient management, use of chemicals and growth regulators, physiological disorders, cropping systems, maturity standards, harvesting, yield, economics of cultivation, post-harvest handling, storage and marketing of tomato, brinjal, capsicum, chilli, okra, cluster bean, cow pea, dolichos bean, french bean, cucumber, melons, gourds and squashes, drumstick, curry leaf, basella, amaranthus, methi, dill, portulaca and sweet corn.

**Practical**

Botany, identification and description of varieties/hybrids of tropical and subtropical vegetables crops, nursery practices, transplanting, field preparation, sowing/planting, use of herbicides, top dressing of fertilizers, interculture, use of growth regulators, identification of nutrient deficiencies and physiological disorders, pests and diseases and their management, harvest indices and maturity standards, working out cost of cultivation and project preparation for commercial cultivation.

**VSC 201 Temperate Vegetables and Tuber Crops 3 (2+1)**

**Theory**

Importance, area, production, origin, export potentials, varieties/hybrids, climate and soil requirements, seed rate, nursery practices, field preparation, transplanting/sowing, spacing, water, weed and nutrient management, use of chemicals and growth regulators, physiological disorders, cropping systems, maturity standards, harvesting, yield, economics of cultivation, post-harvest handling, storage and marketing of cabbage, cauliflower, knol-khol, sprouting brocolli, brussels sprout, lettuce, palak, chinese cabbage, spinach, onion, garlic, leek, radish, carrot, turnip, beet root, peas, broad bean, rhubarb, asparagus, globe artichoke, celery, potato, sweet potato, tapioca, amorphophallus, colocassia, diascoria, horse radish, arrow root, jerusalem artichoke and xanthosoma.

**Practical**

Botany, identification and description of varieties/hybrids of temperate vegetables and tuber crops, modern nursery practices, transplanting, field preparation, sowing/planting, use of herbicides, top dressing of fertilizers, interculture, use of growth regulators, identification of nutrient deficiencies and physiological disorders, pests and diseases and their managements,

harvest indices and maturity standards, working out cost of cultivation and project preparation for commercial cultivation.

**VSC 202 Precision Farming and Protected Cultivation of Vegetables 1 (0+1)**

Importance and scope of precision farming and protected cultivation. Problems/ constrains of greenhouse cultivation and future strategies. Choice of crops for cultivation under greenhouse (tomato, capsicum and cucumber).Study of different types of greenhouses based on shape, construction and cladding materials.Testing of soil and water to study its suitability for growing crops in greenhouses.Media and sterilization process.Bed preparation and planting methods.Laser leveling, mechanized direct seed sowing, seedling and sapling, transplanting, nutrient film technique (NFT).Irrigation and fertigation techniques used in greenhouses. Training and pruning methods.Geographical information system (GIS), pest and disease management practices.Harvest and post-harvest management.Economics of precision farming and protected cultivation. Visit to commercial precision and protected cultivation farms.

**VSC 301 Breeding and Seed Production of Vegetable Crops 3 (2+1)**

**Theory**

History and scope of breeding vegetable crops, methods of reproduction and breeding systems in vegetable crops. Genetic resources, genetics of qualitative and quantitative characters, objectives of breeding, methods of breeding, achievements, maintenance breeding, breeders, foundation and certified seed production, field (isolation distance and rouging) and seed standards for seed production of potato, tomato, chilli, sweet pepper, brinjal, peas, bhendi, dolichos bean, french bean, cow pea, cucumber, musk melon, water melon, bitter gourd, onion, ridge gourd, pumpkin, squashes, cabbage, cauliflower, amaranthus, radish and carrot.

**Practical**

Study of floral biology and pollination mechanisms in vegetable crops, selfing and crossing techniques in vegetable crops, cataloguing of released varieties and hybrids and preparation of plant descriptors for important vegetable crops, preparation and use of chemical and physical mutagens, heterosis breeding and techniques of F1 hybrid seed production, study of seed structure, colour, size, shape and texture, field inspection of seed crops, practices in rouging, seed harvesting and seed extraction and germination and purity analysis. Visit to R & D units of MNCs involved in vegetable breeding and seed production.

**VSC 302 Experimental Techniques in Horticulture 1 (0+1)**

Introduction, national and international research institutes and modern trends and concepts in horticultural research.Aims and objectives of field experiments, sources of variation, uniformity trials and their interpretation. Experimental designs - basic principles, choice of designs, layout, size and shape of plots and arrangement of blocks. Factors considered in fixing treatments. Planning and layout of experiments.Recording of observations, sampling techniques, maintenance of experimental records, tabulations, analysis and interpretation of results. Each student will plan and conduct a field experiment and prepare a research report. Visit to horticulture research/stations.

## III. DEPARTMENT OF FLORICULTURE AND LANDSCAPE ARCHITECTURE

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | FLA 102 | Ornamental Horticulture | 2 (1+1) |
| 2 | FLA 201 | Commercial Floriculture | 2 (1+1) |
| 3 | FLA 202 | Landscape Architecture | 2 (1 +1) |
| 4 | FLA 301 | Protected Cultivation of Flower Crops | 2 (1+1) |
| 5 | FLA 302 | Breeding and Seed Production of Flower Crops | 2(1+1) |
| | | **Total** | **10(5+5)** |

**FLA-102 Ornamental Horticulture 2 (1+1)**

**Theory**

Introduction, history, scope and industrial importance of ornamental horticulture,Basic elements of garden design viz., major and minor elements. Principles of garden design.Styles (formal and informal) and types of garden (features of english, japanese, mughal, french, persian and italian gardens).Garden features/components (garden wall, gates, fence, paths and drives, steps, bridges, hedge, edge, borders, flower beds, carpet bed, lawn, arches and pergolas, terraces).Garden adornments (garden seats/benches, tubs/ urns/ vases, lanterns, statutes, sculptures, fountains, water basins, bird bath, floral clock, sun dials etc.,). Famous gardens of India.Importance, classification, design values and cultivation tips for ornamental plants *viz*. annuals, biennales, herbaceous perennials, bulbous ornamentals, shrubs, trees, climbers, palms and cycads, ferns and sellagenellas, cacti and succulents and indoor plants.Establishment of lawn and maintenance.Bonsai cultureand maintenance. Flower arrangement concepts and Ikebana-techniques, types, suitable flowers and cut foliage. Dry flowers- dehydration techniques and preservation.Floral arts and adornments.

**Practical**

Identification and description of elements, principles, features and adornments in the garden. Nursery practices for raising annuals and potted ornamentals.Planning, designing and establishment of garden features viz. lawn, hedge and edge, flower bed, carpet beds. Identification and description of annuals, biennials, herbaceous perennials, shrubs, trees, climbers, ferns and sellagenellas, palms and cycads, Cacti and succulents, indoor plants. Study of Bonsai techniques, training and maintenance.Practices on of flower arrangement, preparation of bouquets, preparation of floral rangoli, veni*etc*.,Visit to gardens.

**FLA-201 Commercial Floriculture 2 (1+1)**

**Theory**

Scope and importance of commercial floriculture in India.Area and production of flower crops in India.Production techniques of commercial flower crops -rose, chrysanthemum, tuberose, gladiolus, dahlia, china aster, marigold, gaillardia, jasmine, crossandra, bird of paradise, lilies, and heliconia.Postharvest management of flower crops.Essential oil extraction from flowers - rose, jasmine and tuberose.Use of organics in flower crops.Economics and cost of cultivation.

**Practical**

Identification of commercially importantflower crops and their varieties.Nurserypractices in annual flowercrops.Use of growth regulators in propagation by cutting, layering, grafting and budding in flower crops.Training and pruning operations.Use of chemicals and packaging material for prolonging the vase life of cut-flowers.Exposure visits.

**FLA -202 Landscape Architecture 2 (1 +1)**

**Theory**

Importance and scope of Landscape Architecture.Functional uses of plants for landscape and pollution control.Steps in preparation of garden design.Use of Auto CAD and Archi CAD in designing gardens.Use of softwares and software tools for developing landscapes.Bio-aesthetic planning, definition, objectives.Special types of gardens (rock, water, marsh/ bog, sunken, shade, roof, terrace, vertical, instant, dish, traffic island and terrarium).Landscaping for specific areas (home garden, public parks, educational institutes, hospitals, religious places, play-ground, high ways, avenues, industrial area, air port, rail way station and line, bus station, historical place, cemeteries, dam site, river bank).Xeriscaping- definition, principles and practice.

**Practical**

Study of garden equipments.Use of drawing equipments, graphic symbols and notations in landscape designing.

Designing gardens using Auto-CAD/ Archi-CAD.Study and designing of different styles of gardens.

Study and designing of gardens based on different themes.Designing gardens for specific places.

Visit to public/ institutional / botanical gardens.

**FLA-301 Protected Cultivation of Flower Crops 2 (1+1)**

**Theory**

Importance and scope for protected cultivation.Problems, advantages and disadvantages of protected cultivation.Green house technology- Introduction, Greenhouse effect, structure and types of greenhouses.Equipments and materials required for green house construction and management.Factors involved in the green house production and plant response to greenhouse environment.Growing media and sterilization methods.Production technology for rose, carnation, gerbera, chrysanthemum, orchids and anthuriuns (preparation of beds, planting method, nutrition, irrigation, fertigatrion, pest/disease management, harvest and post-harvest management).Cost estimation and economic analysis.

**Practical**

Studies on different types of greenhouses based on shape, construction and cladding materials.

Testing of soil and water for suitability to grow crops in greenhouses.Studies on growing media and sterilization process.Preparation of beds, planting methods and cultural operations.Studies on irrigation and fertigationfacilities.Economics of protected cultivation.Visit to commercial green houses.

**FLA-302 Breeding and Seed Production of Flower Crops 2(1+1)**

**Theory**

History of ornamental plant breeding.Problems in flower crops breeding. Application of breeding techniques (diversity, introduction, selection, hybridization, mutation, polyploidy, biotechnological approaches and development of promising cultivars) for improvement in Rose, Carnation, Gerbera, Chrysanthemum, Orchids, Anthurium, Tuberose, Gladiolus, Dahlia, Jasmine, Crossandra, Hibiscus, Bouganvillea,China aster, Marigold, Gaillardia,Petunia, Zinnia, Cosmos, Dianthus, Antirrhinium.Role of heterosis and its exploitation in flower seed production. Utilization of male sterility in F1 hybrid seed production.Production of open pollinated seeds.Harvesting,processing, certification and storage of seeds.

**Practical**

Classification of plants and plant organs.Taxonomical and trait description of plant organs (roots, branches, leaves, inflorescence).Studies on flower parts.Taxonomy, floral biology and pollination mechanisms in important flower crops.Studies on pollination and fertilization methods.Studies on development of seed.

Studies on seed dispersal mechanisms.Identification of annual flower seeds.Practices on seed production methods.Visit to tissue culture and seed production units.

## IV. DEPARTMENT OF PLANTATION, SPICES, MEDICINAL AND AROMATIC CROPS

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | PMA 102 | Plantation Crops | 3 (2+1) |
| 2 | PMA 201 | Spices and Condiments | 2(1+1) |
| 3 | PMA 202 | Medicinal Crops | 2 (1+1) |
| 4 | PMA 301 | Aromatic Crops | 2 (1+1) |
| 5 | PMA 302 | Breeding of Spices and Plantation Crops | 2(1+1) |
| | | **Total** | **11(6+5)** |

**PMA 102 Plantation Crops 3 (2+1)**

**Theory**

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

**PMA 201 Spices and Condiments 2(1+1)**

**Theory**

History, scope importance and constraints.Present status, area and production, uses, export potential and role in national economy. Classification, soil and climate, propagation-seed, vegetative and micro propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology,

packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board. Export Promotion Council, institutions and research centres in R&D. Crops: Cardamom, pepper, betel vine, ginger, turmeric, clove, nutmeg, cinnamon, kokam, curry leaf, coriander, fenugreek, fennel, mustard and vanilla.

**Practical**

Identification of varieties: propagation, seed treatment – sowing; 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 and research stations.

**PMA 202 Medicinal Crops 2 (1+1)**

**Theory**

History, scope, opportunities and constraints in the cultivation and maintenance of medicinal 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. Important pests and diseases, harvesting and processing of under mentioned important medicinal plants. Therapeutic and pharmaceutical uses of important species.Medicinal crops**:***Withania*, periwinkle, Rauvolfia, Dioscorea, Isabgol, opium poppy, coleus,stevia, long pepper,senna,asparagus,glorylilly,safedmusli , kalmegh, cinchona and *Ammimajus*.

**Practical**

Study and identification of medicinal plants, their morphological description, nursery techniques, varieties.Study of harvesting, Identification and management of important pests and diseases of commercial medicinal crops. Study the concepts and layout of herbal garden. Visit to herbal garden and research stations

**PMA 301 Aromatic Crops 2 (1+1)**

**Theory**

History, scope, opportunities and constraints in the cultivation and maintenance of 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. Important pests and diseases, harvesting and extraction methods of under mentioned important aromatic plants. Uses and economics of essential oils in aromatic plants.Storage techniques of essential oils.

**Aromatic crops**: Citronella, khus, lavender, geranium, patchouli, Lemon scented gum, Mint,ocimum,Lemongrass,palmarosa,davana ,Jasmine,tuberose,sandal wood and Rosemarry

**Practical**

Study and identification of medicinal plants, their morphological description, nursery techniques, varieties.Study of harvesting, curing and processing techniques of different species and extraction of essential oils.Identification and management of important pests and diseases of commercial aromatic crops. Visit to aromatic crop fields distillation units and research stations.

**PMA 302 Breeding of Spices and Plantation Crops 2(1+1)**

**Theory**

History and importance of plantation and spice crops.Research Stations Origin, introduction, distribution, domestication and adoption. Variability for economic traits breeding strategies-clonal selection, poly-clonal orchards bud mutation – mutagenesis and its application in crop

improvement hybrids – haploid and ploidy breeding and In vitro techniques in the improvement of plantation and spice crops. Genetic resources.Objective of breeding principles and methods of breeding and salient breeding achievements of plantation and Spice crops.IPR pertaining to spices and plantation crops.

**Plantation Crops:**Arecanut, Coconut, oil palm, rubber, cashew nut, coffee, tea and cocoa.

**Spice Crops:** Cardamom, black pepper, ginger, turmeric, nutmeg, cinnamom, coriander, fenugreek, fennel and vanilla.

**Practical:**

Floral structure, floral biology and economic products of important perennial horticultural crops, selfing and crossing techniques, handling of breeding populations, preparation of plant descriptors of importance plantation and spice crops. Visit to place of interest including research station in relation to breeding activities of plantation and spice crops. Techniques of raising of segregating lines, evaluation of segregating genera. Techniques of F1 hybrid seed production. Maintenance of breeding records, emasculation and pollination procedures. Maintenance of male sterile lines, preparation of chemical nutrients.Working out the heritability, variety release proposals.Production of hybrids.

## V. DEPARTMENT OF POSTHARVEST TECHNOLOGY

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | PHT 101 | Fundamentals of Food and Nutrition | 2 (1+1) |
| 2 | PHT 301 | Post-Harvest Management of Horticultural Produce | 3(2+1) |
| 3 | PHT 302 | Processing of Horticultural Produce | 3 (2+1) |
| | | **Total** | **8(5+3)** |

**PHT 101 Fundamentals of Food and Nutrition 2 (1+1)**

**Theory**

Food and its functions, physico-chemical properties of foods; Food Preparation Techniques; Nutrition, relation of nutrition to good health, characteristics of well and malnourished population; Energy, food energy, determination of food energy, total energy needs of the body; Carbohydrates- functional properties, classification, functions, sources, requirements, digestion, absorption and utilization. Dietary fibre, physiological effects, role of fibre in human nutrition; Proteins- functional properties, classification, functions, sources, requirements, digestion, absorption, essential and non essential amino acids, quality of proteins, deficiency and complementary value of proteins; Lipids-functional properties, classification, functions, sources, requirements, digestion, absorption and utilization saturated and unsaturated fatty acids, deficiency, rancidity, refining of fats, dietary fat and coronary heart diseases; Water and electrolyte balance; Mineral nutrition-macro and micro minerals, function, utilization, requirements, sources, effects of deficiency; Vitamins- functions, sources, effects of deficiency, requirements of water soluble and fat-soluble vitamins; Anti-oxidants, functional foods and nutraceuticals; Browning reactions in fruits and vegetables; Balanced diet; RDA for various age groups; Assessment of nutritional status of population.

**Practical**

Methods of measuring food ingredients; Effect of cooking on volume and weight; Determination of percentage of edible portion; Browning reactions in fruits and vegetables; Microscopic

examination of starches; Estimation of energy value of foods; Estimation of quality of proteins and fats in foods; Determination of BMI; Planning diet for various age groups.

**PHT 301 Post Harvest Management of Horticultural Produce 3(2+1)**

**Theory**

Importance of post harvest technology in horticulture crops, present status and future scope, pre-harvest factors affecting quality, post-harvest losses and factors responsible for deterioration of horticulture produce; Maturity indices, physiological and biochemical changes during ripening process, hastening and delaying of ripening process; Harvesting, handling, curing, grading and pre-cooling of horticulture produce; Packaging, types of packages, recent advances in packaging, use of grape guard in packaging, cushioning materials; Transportation and modes of transport; Marketing of fresh produce; Pre and post-harvest treatments for extending storage life; Principles and methods of storage.

**Practical**

Study of structure of fruits, vegetables and cut flowers in relation to post harvest physiology; Practices in judging maturity of horticulture produce; Harvesting, sorting and grading of horticulture produce; Estimation of PLW, TSS, titratable acidity, ascorbic acid; Post harvest treatment of horticulture produce-Hot water treatment, wax, growth regulators, calcium compounds and fungicides on shelf life and quality on horticulture produce; Packaging of important horticulture crops; Study of design and construction of ZECC; Study on cold storage of fruits, vegetables and flowers; Storage disorders and spoilages in horticulture produce. Visit to markets, packing houses and cold storage units.

**PHT 302 Processing of Horticultural Produce 3 (2+1)**

**Theory:**

History, importance, present status and future scope of fruit and vegetable preservation industry in India; Unit operations in food processing; General principles of preservation of horticulture produce; Chemical preservatives; Principles and methods of drying and dehydration; Preservation by heat; Preservation by use of sugar and chemicals; Preservation by salt, spices, essential oils and vinegar; Preservation by fermentation and freezing; Minimal processing of fruits and vegetables; Curing and processing of spices and plantation crops; Packaging of processed products; Spoilages in processed products; Quality control of processed products and food laws, Government policies on import and export of processed horticulture produce; Principles and guidelines for establishment of processing industry.

**Practical**

Study of tools and equipments used in processing of horticulture produce; Study of packages (rigid and flexible) used for processed foods; Preparation of dried and dehydrated products; Raisin preparation; Preparation of juice, RTS, nectar, cordial, squash, syrup, jam, jelly, candied and crystallized products, preserve (Murabba), tomato ketchup and sauce, pickles; Canning of fruits and vegetables; Study of spoilage in canned foods; Freezing preservation; Preparation of wines; Curing and processing of regionally important spices and plantation crops; Visit to processing industries.

## VI. DEPARTMENT OF ENTOMOLOGY

| Sl. No | Course No | Title of Courses | CreditHrs |
|---|---|---|---|
| 1 | ENT 102 | Fundamentals of Entomology | 2(1+1) |
| 2 | ENT201 | Principles of Pest Management and Productive Insects | 3 (2+1) |
| 3 | ENT301 | Pests of Vegetable, Ornamental and Spice Crops | 2 (1+1) |
| 4 | ENT302 | Pests of Fruit, Plantation, Medicinal and Aromatic Crops | 3(2+1) |
| | | **Total** | **10(6+4)** |

**ENT 102 Fundamentals of Entomology 2(1+1)**

**Theory**

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

**Practical**

Insect collection and preservation.General body organization of insects. Study on morphology of grasshopper or cockroach. Preparation of permanent mounts of mouth parts, antennae, legs and wings. Dissection of grasshopper/cockroach and caterpillar for study of internal anatomy.Studies on biology of important insects.Observations on moulting and metamorphosis. Types of eggs , larvae and pupae. Identification of insects representing economically important orders and families. Study on morphology of important families of mites

**ENT 201 Principles of Pest Management and Productive Insects 3(2+1)**

**Theory**

Economic classification of Insects.Pest-definition and types of pests, types of damage caused by pests.Concept of ETL and EIL in pest management.Factors for outbreak of pest populations.Pest survey, surveillance and forecasting.Pest management-Definition and importance; Methods of pest management - Mechanical, Cultural, Physical, Legal, Biological and Chemical.Biorational and Biotechnological approaches in pest management. Integrated pest management- Principles and its components; advantages and disadvantages.Biological control- predators, parasitoids, entomopathogens and weedkillers and their mass production and use. Insecticides: Classifications of insecticides based on mode of entry, action and chemical nature; Insecticides formulations and their uses; safe handling of insecticides

Importance and History of apiculture. Species of honey bees- Rock bee, Little bee, Indian bee, European bee, and Dammar bee, lifecycle and caste determination. Beekeeping Appliances.Establishment of apiary, Bee colony maintenance in different seasons.Importance of bee pollination in horticulture crops. Honey extraction, honey composition and value, bee wax and other hive products. Pests and diseases of honey bees.Economics of beekeeping.

Importance, history and development of Sericulture in India, different kinds of silkworms and their host plants.Mulberry silkworm-morphology, races, rearing house and equipments.Silkworm rearing. Cocoon quality and processing. Uses of silk and by-products.Economics of silk production.Moriculture- establishment of mulberry garden and its management.Lac cultivation in India.Lac insects, biology, types, lac cultivation and host plants.Uses of lac.

**Practical**

Assessment of pest damage/ETL.Pest monitoring devices and forecasting. Studies on Beneficial insects- Predators, Parasitoids and their mass production. Different entomopathogens and their mass produciton and usage. Visit to biocontrol laboratories. Classification of insecticides and their formulations.Preparation and usage of botanical insecticides. Study of plant protection appliances. Safe handling of pesticides and pesticide residues.

Honey bee colony, different bee hives and apiculture equipment. Summer and Winter management of colony. Colony multiplication and uniting. Honey and wax extraction, Processing and bottling of honey. Study of pests and diseases of honeybees. Visit to apiary.

Establishment and maintenance of mulberry garden.Study of different kinds of silkworms and mulberry silkworm morphology.Sericulture equipments and rearing facility.Rearing of silkworms.Study of silkworm pests, diseases and their management. Visit to sericulture unit.

**ENT 301 Pests of Vegetable, Ornamental and Spice Crops 2(1+1)**

**Theory**

Economic importance of insects and mites in vegetable and spice crops -ecology and pest management with reference to these crops. Pest surveillance in important vegetable and spice crops. Distribution, host range, bio-ecology, injury, integrated management of important insect and mite pests affecting vegetable and spice crops like brinjal, tomato, chilli, bhendi, potato, sweet potato, onion, garlic, crucifers- cabbage and cauliflower, cucurbits- melons and gourds, leguminous and leafy vegetables, rose, jasmine, chrysanthemum, marigold, tuberose, gladiolus, carnation, gerbera, black pepper, ginger, turmeric, cardamom, curry leaves, coriander and tree spices. Important storage insect-pests of vegetable and spice crops, their host range, bio-ecology, injury and integrated management. Insect – pests of processed vegetables and spice crops, their host range, bio-ecology, injury and integrated management. Insecticidal residue problems in vegetables and spice crops, MRL, PHI etc.

**Practical**

Collection and preservation of damaging stages on different vegetable, ornamental and spice crops. Study of symptoms, damage, collection, identification, preservation, assessment of damage/population of important insect-pests affecting vegetable, ornamental and spice crops in field and during storage. Application of IPM components in various crops. Studies on pesticide resides, their MRL and PHI. Visit to Vegetable, Ornamental and spice crop fields.

**ENT 302 Pests of Fruit, Plantation, Medicinal and Aromatic Crops 3(2+1)**

**Theory**

Bio-ecology and management of insect and mite pests in fruit, plantation, medicinal and aromatic crops; Pest surveillance. Distribution, host range, bio-ecology, injury, integrated management of important insect and mite pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops like mango, guava, grapes, banana, citrus, sapota, pomegranate, ber, pineapple, papaya, jamun, fig, custard apple, apple, jack, coconut, areca nut, oil palm, cashew, cacao, tea, coffee, betelvine, rubber, cinchona, ashwaghanda, senna, neem, pyrethrum, costus, mint, *Solanum*sp*,* lemongrass, patchouli.Storage insects – distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking stored fruits, plantation,

medicinal and aromatic crops and their processed products. Insecticide residue problems in fruits, plantation, medicinal, and aromatic crops and their maximum residue limits (MRLs).

**Practical**

Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect – pests affecting fruits, plantation, medicinal and aromatic crops in field and storage. Installation of pest monitoring devices and decision making in various crops. Studies on pesticide resides, their MRL and PHI. Visit to Fruit orchards, plantations crops and medicinal and aromatic crops. Collection and identification of damaging stages and adult insects.

## VII. DEPARTMENT OF PLANT PATHOLOGY

| Sl. No | Course No. | Title of the course | Credit hours |
|---|---|---|---|
| 1 | PAT 102 | Fundamentals of Plant Pathology | 3 (2+1) |
| 2 | PAT 201 | Diseases of Fruit, Plantation, Medicinal and Aromatic Crops | 3 (2+1) |
| 3 | PAT 301 | Diseases of Vegetable, Ornamental and Spice Crops | 3 (2+1) |
| | | **Total** | **9(6+3)** |

**PAT 102 Fundamentals of Plant Pathology 3(2+1)**

**Theory**

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

**Practical**

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

**PAT 201 Diseases of Fruit, Plantation, Medicinal and Aromatic Crops 3 (2+1)**

**Theory**

Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of fruits, plantation, medicinal and aromatic crops *viz* mango, banana, grape, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, ber, apple, pear, peach, fig, custurd apple, plum, strawberry, areca nut, coconut, oil palm, coffee, tea, cocoa, cashew, rubber, betel vine senna, neem, hemp, costus, datura, dioscorea, mint, opium, pachouli, citronella, davana, ocimum, sandal and*Solanumviarum*. Important post-harvest diseases of fruit, plantation and medicinal and aromatic crops and their management.

**Practical**

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

**PAT 301 Diseases of Vegetable, Ornamental and Spice Crops 3(2+1)**

**Theory**

Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following vegetables, ornamental and spice crops: tomato, brinjal, chilli, bhindi, cabbage, cauliflower, radish, knol-khol, pea, beans, beet root, onion, garlic, fenugreek, ginger, potato, cucurbits, sweet potato, carrot, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, cinnamon, jasmine, rose, crossandra, tuberose, gerbera, anthurium, geranium, marigold, chrysanthemum, carnation, gladiolus, vanilla. Important post-harvest diseases of vegetables and ornamental crops and their management.

**Practical**

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

## VIII. DEPARTMENT OF BCI

| Sl. No | Course No | Title of Courses | Credit Hours |
|---|---|---|---|
| 1 | BCH 101 | Elementary Plant Biochemistry | 2(1+1) |
| 2 | CPH 101 | Introductory Crop Physiology | 2(1+1) |
| 3 | CPH 102 | Growth and Development of Horticulture Crops | 2(1+1) |
| 4 | GPB102 | Principles of Genetics and Cytogenetics | 3(2+1) |
| 5 | GPB 201 | Principles and Methods of Plant Breeding | 3(2+1) |
| 6 | PBT 202 | Introduction to Plant Biotechnology | 2(1+1) |
| 7 | SST 202 | Principles of Seed Production in Horticulture Crops | 2(1+1) |
| | | **Total** | **16 (9+7)** |

**BCH 101 Elementary Plant Biochemistry 2(1+1)**

Introduction, Brief History, Scope of Biochemistry in Horticulture, Biomolecule-Carbohydrates-Definition, classification and structure, physical and chemical properties of carbohydrates, isomerism, optical activity, reducing property, reaction with acids and alkalis, ozone formation, Plant cell wall carbohydrates and their importance. Lipids-classification, fatty acids and triglycerides, essential fatty acids.Physical and chemical properties of lipids - their solubility, melting point, taste, rancidity, Saponofication, Iodine no, Acid no, RM no. Phospholipids - types and importance. Plant pigments – structure and function of chlorophyll and carotenoids, sterols, basic structure, role of brassino sterols in plants. Amino acids – classification and structure, essential amino acids, properties of amino acids -Solubility, melting point, optical properties, zwitter ion, Ampholites, Isoelectric pHcolour reactions, amphoteric nature and isomerism; Proteins – Classification based on function, nutrition and composition. Functions of Proteins, structure of proteins –primary, secondary tertiary and quaternary properties structures. Nucleic acids – Types, structure and function. Enzymes: Definition, chemical nature and properties, Classification. Models of enzyme-substrate interaction: Lock and Key model and Induce fit model; factors affecting enzyme action, co-factors and coenzymes. Metabolism-Basic concept,

differentiation of anabolism and catabolism.Carbohydrate metabolism – glycolysis and TCA-cycle; metabolism of lipids - fatty acid oxidation, biosynthesis of fatty acids; general reactions of Amino acids.Bioenergetics-laws of thermodynamics, entropy, enthalpy, Free energy-Definition only.High energy compounds-ATP-structure.Biological oxidation, Substrate level phosphorylation, bioenergetics of glucose and fatty acids oxidation.

**Practical:**

Introduction. Buffers, Concept of pH, Solutions- types Standard, Per cent, Normal, Molar, molal, Buffers. Preparation of standard solutions and reagents; Carbohydrates: Qualitative reactions determination with glucose, fructose, maltose, sucrose, lactose and starch as examples; Estimation of starch; Estimation of reducing and total sugars from fruits; Amino acids: Qualitative determination. Amino acids; Proteins: Estimation of proteins by Lowry's method and Biuret method; Fatty acids: Estimation of free fatty acids; Determination of iodine number of vegetable oils: Estimation of Ascorbic acid; Estimation of Phenol; Techniques: Paper chromatography, Thin layer chromatography- separation of plant pigments, separation of amino acids: pigments extracted from flowers, Demonstrations:Extraction of oil from oil seeds; Enzymes: Enzyme assay-α-amylase, invertase, acid phosphatase. Enzyme Immobilization.

**CPH 101 Introductory Crop Physiology 2(1+1)**

**Theory**

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

**Practical**

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

**CPH 102 Growth and Developmentof Horticulture Crops 2(1+1)**

**Theory**

Growth and development: Definitions, components, photosynthetic productivity, Canopy photosynthesis and productivity, leaf area index (LAI): Optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, Crop development and dynamics (Case studies of annual/perennial horticultural crops), growth analysis in horticultural crops. Plant bio-regulators: auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering: Factors affecting flowering,

physiology of flowering, photoperiodism - long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training- physiological basis of training and pruning, source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non-climacteric fruits. Physiology of fruits under post-harvest storage.

**Practical**

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

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

**Theory**

Historical background of genetics, theories and hypothesis.Cell and cell organelles, cell division; mitosis, meiosis and its significance. Gametogenesis, syngamy and reproduction in plants, Physical basis of heredity; chromosome structure, function, Chromosome theory of inheritance Chromosomal aberrations, changes in chromosome structure and number and their evolutionary consequences with examples from plants and animals..

Mendelian Genetics: Mendel's principles of heredity, deviation from Mendelian inheritance. Modification of monohybrid and dihybrid ratios: Linkage and crossing over, Pleiotropy, threshold characters, penetrance and expressivity, Gene interaction, Multiple alleles, Quantitative inheritance. Sex linked inheritance and characters, sex determination. Non-Mendelian inheritance: Cytoplasmic inheritance and maternal effects. Mutations and their classification. Chemical basis of heredity: structure of DNA and its replication. Evidence to prove DNA and RNA – as genetic material, their structure, function, genetic code. Concept of central dogma: DNA Replication, transcription, translation. Gene regulation (Lac operon).

**Practical**

Study of Microscopes, preparation of fixatives and stains. Mitosis and meiosis slide preperation, demonstrations of permanent slides and cell division. Illustration in plant cells, pollen fertility and viability, determination of gametes, Exercises on monohybrid, dihybrid, and test cross ratios, chi-square test, gene interactions, estimation of linkages using three point test cross from F2 data and construction of linkage maps. Multiple alleles, Sex linkage, polygenic inheritance.

**GPB 201 Principles and Methods of Plant Breeding 3 (2+1)**

**Theory**

Plant breeding as a dynamic science, Genetic basis of Plant Breeding – Classical, Quantitative and Molecular Breeding. Plant Breeding in India – History, Land marks, major achievements, Scope and limitations. Implications of reproductive systems on population structure. Modes of reproduction: Sexual reproduction ; Cross and Self-pollination, Asexual reproduction and Apomixis. Pollination control mechanism ; Self incompatibility and Male sterility. Emasculation, Pollination techniques in important horticultural crops. Centers of Origin of crop Plants. Plant Genetic Resources, Domestication of Crop Plants. Plant Introduction. Breeding methods in Self, Cross and Clonal crops; Selection and Hybridization Development & Evaluation of Inbreds–

Simple crosses, Bulk crosses and Complex crosses. Quantitative Genetics models.Heterosis – concepts, estimation and its genetic basis. Calculation of heterosis, GCA, SCA, inbreeding depression, Population Improvement approaches, Marker assisted selection. General and special breeding techniques; Mutation breeding, Polyploidy Breeding and Interspecific hybridization by tissue culture techniques.Breeding for resistance of biotic and abiotic stresses. Genetic components of Polygenic variation and Breeding strategies, Hardy Weinberg law and its factors. Varietal release, IPR, Plant breeders rights, farmers rights and community rights. Crop Research Institutes.

**Practical**

Breeding objectives and techniques in important horticultural crops.Breeders kit. Floral biology, emasculation, crossing and selfing techniques in major crops. Determination of mode of reproduction in crop plants, Pollen viability and pollen germination studies. Field layout, and maintenance of experimental records in self and cross pollinated crops. Demonstration of hybrid variation and production techniques.Mutation and polyploidy breeding. Hardy Weinberg Law and calculation, Male sterility and Self incompatibility studies in horticultural crops calculation of inbreeding depression, heterosis, heterobeltosis, Assessment of superiority of genotypes by ANOVA, Variability estimates : GCV, PCV, GA, heritability.

**PBT 202 Introduction to Plant Biotechnology 2(1+1)**

**Theory**

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant GeneticEngineering, Scope and importance in Crop Improvement. Totipotency and Morphogenesis.Nutritional requirements of in-vitro cultures. Techniques of In-vitro cultures: Micropropagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting in-vitro culture, Applications and Achievements. Somaclonal variation: Types and Reasons. Somatic embryogenesis and synthetic seed production technology.Protoplast isolation, Culture, Manipulation and Fusion, Products of somatic hybrids and cybrids, Applications in crop improvement.Callus and suspension culture, in vitro secondary metabolites production. Genetic engineering: Restriction enzymes, Vectors for gene transfer, Gene cloning: Direct and indirect method of gene transfer, Transgenic plants and their applications. Genome editing and its applications; Blotting techniques, DNA fingerprinting: DNA based markers – RFLP, AFLP, RAPD, SSR, SNP and DNA Probes, Mapping QTL – Future prospects. Introduction to MAS, and their application in crop improvement.Nano-biotechnology Definition and scope.

**Practical**

Requirements for Plant Tissue Culture Laboratory.Sterilization techniques.Inoculation of various explants, Media components and preparations. Techniques in Plant Tissue Culture: Aseptic manipulation of various explants, Callus induction and Plant Regeneration, Micro propagation of important crops. Anther, Embryo and Endosperm culture.Hardening / Acclimatization of regenerated plants.Isolation of protoplast, Demonstration of Culturing of protoplast. Isolation of DNA; Demonstration of gel-electrophoresis techniques, Demonstration of PCR, Demonstration of Gene transfer techniques: direct methods, indirect methods. Demonstration of Confirmation of Genetic transformation,

**SST 202 Principles of Seed Production in Horticulture Crops 2(1+1)**

**Theory**

Introduction, seed and its importance, difference between seed and grain, role of seed technology. Concept of seed quality and factors affecting to it. History and development of seed industry, new

seed policy, National seed projects, classes of seeds, generation system of seed multiplication and agency involved in production and certification. General principles and methods of seed production in self and cross pollinated varieties and hybrids of horticultural crops. Harvest and post harvest technology- principles of seed processing. Principles and methods of seed drying.Seed certification – purpose and phases of seed certification, field inspection and its importance, field and seed standards.Duties and responsibilities of seed inspector and seed analyst, Seed storage- principles and methods, factors affecting the storage of certified, foundation, breeder seeds and germplasm seeds.Seed deterioration- factors affecting seed deterioration and its control.Seed act and rules, important sections and rules. Seed control order.

**Practical**

Identification of seeds and varieties of important horticulture crops. Seed structure of dicot and monocot. Seed sampling and testing equipments. Testing of moisture, physical purity, germination, seedling evaluation and reporting the results. Viability test, vigour test, seed dormancy and breaking methods, Grow-out test, seed health test.Hybridization techniques-Emasculation and pollination.Field inspection- Identification of rogue and off types. Seed cleaning, seed treatment and seed packaging. Visit to the certified seed production plots, processing unit, storage unit, KSSC, KSSOCA, STL and private seed company.

## IX. DEPARTMENT OF NRM

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| **a.** | **SOIL SCIENCE AND AGRICULTURE CHEMISTRY** | | |
| 1 | SAC 101 | Fundamentals of Soil Science | 2(1+1) |
| 2 | SAC 201 | Soil, Water and Plant Analysis | 2(1+1) |
| 3 | SAC 302 | Soil Fertility and Nutrient Management | 2(1+1) |
| | | **Total** | **6(3+3)** |
| **b.** | **AGRONOMY** | | |
| 1. | AGR 201 | Water Management in Horticulture Crops | 2(1+1) |
| 2. | AGR 202 | Agro-meteorology and Climate Change | 2(1+1) |
| 3. | AGR 301 | Major Field Crops | 2(1+1) |
| 4. | AGR 302 | Organic Farming | 2(1+1) |
| 5. | AGR 303 | Weed Management in Horticulture Crops | 1 (0+1) |
| | | **Total** | **9(4+5)** |
| **c.** | **AGRICULTURAL MICROBIOLOGY** | | |
| 1 | AMB 101 | Fundamentals ofMicrobiology | 2(1+1) |
| 2 | AMB 202 | Soil and Applied Microbiology | 2(1+1) |
| | | **Total** | **4(2+2)** |
| **d.** | **FORESTRY** | | |
| 1 | FOR 302 | Introductory Agro-forestry | 2(1+1) |
| **e.** | **ENVIRONMENTAL SCIENCE** | | |
| 1. | ENS 202 | Environmental Studies and Disaster Management | 2 (2+0) |
| **f.** | **AGRICULTURAL ENGINEERING** | | |
| 1 | AEG 102 | Surveying, Soil and Water Conservation | 1(0+1) |
| 2 | AEG 202 | Farm Power and Machinery | 2(1+1) |
| | | **Total** | **3(1+2)** |

| | |
|---|---|
| **Total** | **26 (13+13)** |

## a. SOIL SCIENCE AND AGRICULTURE CHEMISTRY

**SAC 101 Fundamentals of Soil Science 2(1+1)**

**Theory**

Composition of earth's crust; Soil as a natural body – major components; Rock & Minerals classification; Weathering of rocks and minerals; Soil Forming factors; Soil forming processes-fundamental and specific; Soil profiles and descriptive master horizons; Soil density particle density, bulk density, relation between BD (bulk density) PD (particle density) and factors influencing; Soil texture-stock's law; Soil structure; Soil consistency, Soil plasticity, Atterberg's constants; Soil Porosity, Soil compaction and Soil crusts; Soil colour; Soil air; Soil temperature; Soil colloids - organic, inorganic, amorphous clays; Ion exchange; Soil water forms and classification, soil moisture constants, energy concepts, PF scale soil moisture measurements, soil water movement –hydraulic conductivity of soil; Soil survey, Remote sensing and GIS their interpretation; Soil orders; Soils of Karnataka and India; Land capability classification

**Practical**

Study of rocks and minerals; Estimation of pH and EC; Determination of BD and Particle density; Textural analysis of soil by Feel method, Robinson's pipette and hydrometer methods.Use of Keen's cup for determination of soil physical properties; Description of soil profile; Determination of soil temperature; Determination of Soil colour using Munsell Chart. Determination of Soil temperature; Determination of soil moisture by gravimetric method; Determination of hydraulic conductivity; Determination of CEC; Aggregate size distribution analysis of soil; Use of aerial photography and satellite images

**SAC 201 Soil, Water and Plant Analysis 2(1+1)**

**Theory**

Methods of soil, plant and irrigation water sampling and processing for analysis; Soil analytical methods for estimation of pH, EC, Organic Carbon, Primary (Available N, P& K), Secondary(Ca, Mg & S) and Micronutrients (Fe, Zn, Cu &Mn) ; Leaf analytical methods for estimation of Primary (N, P& K), Secondary(Ca, Mg & S) and micronutrients (Fe, Zn, Cu &Mn); Soil test interpretation; Index tissue, interpretation of leaf analysis values- concept of nutrient concentration and uptake; Rapid tissue tests for plant; Quality of irrigation water- estimation of pH, EC, SAR and RSC; Working principles of pH meter, Conductivity bridge, Spectrophotometer, Flamephotometer and Atomic absorption spectrophotometer. Radio tracer techniques in plant nutrient studies;

**Practical**

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

**SAC 302 Soil Fertility and Nutrient Management 2 (1+1)**

**Theory**

Introduction to soil fertility and productivity- factors affecting; Essential plant nutrient elements- functions, deficiency systems, transformations (N, P, K & S) in soil and availability; Problematic Soils- Acid, calcareous, salt affected soils and waterlogged soils– characteristics and management; Soil organic matter, humus formation, Importance of C:N ratio; Soil reaction and plant nutrition; Soil buffering capacity- Q-I relationships; Integrated plant nutrient management; Soil fertility evaluation methods; Critical limits of plant nutrient elements- deficiency, hidden hunger, optimum concentration, luxury consumption and toxicity and their remedies; Nutrient interactions; Fertilizers- classifications- straight, complex, mixed; Secondary and micronutrient fertilizer; Manufacturing processes and properties of commonly used fertilizers (Urea, DAP, SSP, MOP and SOP) and application methods; Fertilizer control order; Bio fertilizer; Organic Manures classification and importance; Nutrient use efficiency and management; Soil test crop response and targeted yield concept.

**Practical**

Analysis of soil for organic matter, available N,P, K Gypsum requirement of alkali soils. Lime requirement of acid soils. Sampling of organic manure and fertilizer for chemical analysis.Physical properties of organic manure and fertilizers.Total nitrogen in urea and farmyard manure. Estimation of ammonical nitrate nitrogen in N fertilizer. Estimation of water soluble $P_2O_5$, Ca and S in SSP, Lime and Gypsum.Estimation of Potassium in MOP/SOP and Zinc in zinc sulphate.Visiting of fertilizer testing laboratory.

## b. AGRONOMY

**AGR 201 Water Management in Horticulture Crops 2(1+1)**

**Theory**

Importance of water and water management in Horticulture, water resources in India definition of irrigation.Area of different crops under irrigation, function of water for plant growth, effect of moisture stress on crop growth.Soil-water-plant-atmosphere continuum, consumptive use of water, 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 – critical stages of crop growth for irrigation. Irrigation scheduling – different approaches – methods of irrigation – surface and sub-surface drip irrigation, sprinkler and drip irrigation, their suitability, merits and limitations, fertigation/nutrigation, economic use of irrigation water. irrigation management practices for different soils and crops. Layout of different irrigation systems, drip, sprinkler.Layout of underground pipeline system.Ill effects of poor Water management, suitability of soil for irrigation .Importance of quality of irrigation water.

**Practical**

Estimation of soil moisture constants and soil moisture by different methods and instruments, Measurements of irrigation water by using water measuring devices, use of common formula in irrigation water calculation, layout for different methods of irrigation. 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.

**AGR 202 Agro-meteorology and Climate Change 2(1+1)**

**Theory**

Agricultural Meteorology- Introduction, definition of meteorology, scope and practical utility of Agricultural meteorology. Composition and structure of atmosphere and definition of weather and climate, aspects involved in weather and climate, atmospheric temperature, soil temperature, solar radiation, atmospheric pressure, atmospheric humidity, evaporation and transpiration, monsoons, rainfall, clouds, drought, weather, atmospheric pollution and role of meteorology. Weather forecasting.

Climate change-causes.Global warming-causes. IPCC and Keyto protocol and Effect of climate change on important horticulture crops; Past and future changes in greenhouse gases within the atmosphere. Sources and sinks for greenhouse gases. Plants sense and response to changes in $Co_2$ concentration.Measurement of mechanisms underlying the observed responses in C3 and C4 species.plant development affected by elevated $Co_2$. Physiology of raising $Co_2$ on nitrogen use and soil fertility, its implication for production.Methodology for studying effect of $Co_2$.The mechanisms of ozone and UV damage and tolerance in plants.Increased temperature and plants in tropical/sub-tropical climates- effect on growing season, timing of flowering, duration of fruit development and impacts on crop yields and potential species ranges, interaction of temperature with other abiotic/biotic stress.Mitigation strategies under abiotic stress.

**Practical**

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

**AGR 301 Major Field Crops 2(1+1)**

**Theory**

Classification and distribution of field crops, cultural practices for raising major cereals (rice, wheat, maize, sorghum and ragi), pulses (redgram, bengalgram, greengram and blackgram), oil seeds (groundnut, sunflower, safflower, soyabean and sesamum), commercial crops (sugarcane, cotton and tobacco) and fodder crops (Napiergrass and lucern), green manuring crop (sunhemp, Glyricidia and dhaincha).Disease and Pest of important field crops.

**Practical**

Recent area, production and productivity of major field crops, Botany and description of crops; Identification of crop plants and seeds. Calculation of seed rate and optimum plant Population, Calculation of fertilizer requirement, Analysis of quality parameters of sugarcane, Study of quality parametres of cotton, Study of quality parametres of Tobacco, Establishment and maintenance of crop cafeteria. Calculation of Cost of cultivation. Visit to Tobacco research station, Visit to Khadigramodyoga, Visit to Sugar Industry and Jaggery Unit.

**AGR 302 Organic Farming 2(1+1)**

**Theory**

Introduction, concept, relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manures, Composting, vermicomposting, insitu vermicomposting, Liquid organic manures-BDLM, Panchagavya, Jeevamrutha, Beejamrutha, vermiwash, vermicompost tea, compost tea etc., green manuring, recycling of organic residues,

Biofertilizer; Soil improvement and amendments; Integrated diseases and pest management – use of Biocontrol agents, Biopesticides pheromones, trap crops, bird perches; Weed management-biological and physical methods; Quality considerations, certification, labeling and accreditation procedures, marketing, exports.

**Practical**

Preparation of panchagavya, Jeevamrutha, Beejamrutha, chilli, Onion and Garlic extract, Preparation of Tobacco, Neem, Papaya, Lantana and custard leaf extract etc., Preparation of NSKE. Analysis of Nutrient composition in organic manures. Raising of ***vegetable***(Horticulture) crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, postharvest management. Visit to organic farming farms. Visit to dairy, Sheep, Goat and poultry units to study resource allocation. Visit to Neem cake production units.

**AGR 303 Weed Management in Horticulture Crops 1 (0+1)**

**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, cuscuta, Orobenchae, Loranthus and celosia; Economics of weed control practices; Tours and visits to problematic areas.

## c. AGRICULTURAL MICROBIOLOGY

**AMB 101 Fundamentals of Microbiology 2(1+1)**

History and scope of Microbiology: the discovery of microorganisms, spontaneous generation conflict. Germ theory of diseases.Development of microbiology in India. Different groups of microorganims and their characteristics. Prokaryotes and eukaryotes, Prokaryotic cell structure and function. Microscopy: basics of microscopy- numerical aperture, resolving power, types of microscopes, Bright field microscopy, specimen preparation, dyes and stains, simple staining, differential staining, gram staining. Microbial growth media: types of culture media. Growth of bacteria, fungi and their growth measurements.Microbial growth curve. Sterilization techniques: physical and chemical. Pure-culture techniques, isolation or preparation of pure cultures and preservation of microbial cultures. Viruses: their general characteristics and brief description of bacteriophages. Industrial applications of microorganisms. Mushrooms: edible and poisonous types, nutritive values, culturing and production technique of oyster and button mushrooms.

**Practical**

Sterilization techniques.Preparation of microbial culture media.Examination of natural samples for microorganisms.Isolation of bacteria, fungi and yeasts. Serial dilution plate count techniques. Isolation of bacteriphages (plaque forming units). Preparation of culture broths, agar slants. Pure-culture techniques.Turbidometric estimation of microbial growth. Mushroom culture: spawn production, culture and production techniques, harvesting, packing and storage techniques.

**AMB 202 Soil and Applied Microbiology 2(1+1)**

**Theory**

Soil environments and microbial dynamics.Factors affecting microbial activities in soils and different environments. Microbes in minerals / elemental transformations: Carbon cycle, organic matter decomposition and humus formation. Nitrogen cycle: Biological nitrogen fixation: symbiotic, asymbiotic& associative $N_2$-fixation, different kinds of symbiotic nitrogen fixation, ammonification, nitrification, denitrification, Factors affecting ammonification & Nitrification. Phosphorus Transformation: Mineralization, Mineral phosphate solubilization, Mechanisms of Phosphate solubilization by microorganisms. Mycorrhizae: Ecto- & Endo-Mycorrhizae and their symbiosis with crop plants and forest crops, mobilization of Phosphorus by mycorrhizae. Microbial interactions: commensalism, ammensalism, synergism, symbiosis, predation, parasitism, microbial succession *etc*. Rhizosphere concept & R:S Ratio. Phyllosphere and Spermosphere.Soil enzymes and their role in soil fertility. Role of microorganisms in waste disposal and composting, different methods of composting farm wastes. Application of microorganisms in industries: Biofertilizers and Biopesticides. Microbial fermented products of fruits and vegetables.

**Practical**

Isolation and enumeration of soil bacteria, fungi and actinomycetes using serial dilution technique.Isolation and enumeration of free living $N_2$ fixing microorganisms from soil.Isolation of *Rhizobium* from root nodules of legumes (symbiotic $N_2$ fixing Microorganisms).Isolation of associative nitrogen fixing microorganisms (*Azospiriullum*) from roots of crop plants.Isolation and enumeration of phosphate solublizing microorganisms from soil.Isolation and study VA Mycorrhiza spores from soil and study of VAM root colonization. Isolation and enumeration of microorganisms from rhizosphere and non-rhizosphere soil and calculation of R:S ratio. Study of phyllosphere and spermosphere microorganisms.Isolation of cellulose decomposing microorganisms by enrichment technique.Study of soil microorganisms by buried-slide technique.Isolation and blue green algae from soil.Assessment of microbial activity in soil by dehydrogenase activity. Microbial interactions- antibiosis, Study of organic matter decomposition and $CO_2$ evolution. Study of ammonification, nitrification and denitrification in soil. Production of microbial fermented products from fruits and vegetables: sauerkraut.

## d. FORESTRY

**FOR 302 Introductory Agro-forestry 2(1+1)**

**Theory**

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

**Practical**

Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, Grewiaoptiva, Morusalba, Acacia catechu, *Dalbergiasissoo*, robinia, leucaena etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops: silvipastoral, alley cropping, horti-silviculture, agro-silvipasture, fuel and fodder blocks. Visit to social forestry plantations – railway line plantations, canal plantations, roadside plantations, industrial

plantations and shelterbelts. Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages. Economics and marketing of products raised in agro-forestry systems.

## e. ENVIRONMENTAL SCIENCE

**ENS 202 Environmental Studies and Disaster Management 2(2+0)**

**Theory**

Environment - Definition, scope and importance; Different natural resources: classification – forest, water, mineral, food, energy and land resources; utilities, problems of over exploitation, associated damages and conservation measures for the above resources; Ecosystems – Concept, Structure and functions, components-Producers, consumers and decomposers; Energy flow; Ecological succession; Concepts of Food chains, food webs and ecological pyramids; Salient features of different ecosystems – forest, grassland, desert, aquatic ecosystems; Biodiversity – Introduction, definition, genetic, species & ecosystem diversity; different aspects, values and conservation of biodiversity; National and global biodiversity hotspots; values of biodiversity-consumptive use, productive use, social, ethical, aesthetic and option values. Threats to biodiversity; habitat loss, wildlife poaching, man-wildlife conflicts; endangered and endemic species; *In-situ* and *Ex-situ* conservation measures. Environmental Pollution: Different types and definitions; causes, effects and preventive control measures of air, water, soil and nuclear pollution; Solid Waste Management: causes, effects and control measures of urban and industrial wastes.Concept of sustainable development issues; exploitation of water resources; Important environmental acts/ policies relevant to conservation and protection, Human Population and the Environment; Human Rights issues; Role of IT in Environment protection;.Natural Disasters-Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, Disaster Management- strategies and concepts; National framework and financial arrangements in disaster management; Effect to mitigate natural disaster at national and global levels; Role of NGOs, community and governmental organizations.

## f. AGRICULTURAL ENGINEERING

**AEG 102 Surveying, Soil and Water Conservation 1(0+1)**

**Practical:**

Acquaintance with chain survey equipment; Ranging and measurement of offsets; Chain triangulation; Cross staff survey; Plotting of chain triangulation; Plotting of cross staff survey; Compass survey (surveyor's and prismatic compass) and Leveling equipment – dumpy level, leveling staff, temporary adjustments and level staff reading; Differential leveling; contours; Concept of watershed. soil and water conservation measures in watershed. Layout of contour bund, water ways, farm pond etc. Delineation of watershed and preparation of master plan.

**AEG 202 Farm Power and Machinery 2(1+1)**

Basic concepts of various forms of energy, unit and dimensions of force energy and power, calculations with realistic examples. IC Engines: Basic principles of operation of compression, ignition and spark ignition engines, two stroke and four stroke engines, IC engine terminology,

Engine components, types of IC engine, tractor and there use, classification and selection of tractor, power transmission system of tractors, Tillage: objectives, method of ploughing. Primary tillage implements: construction and function of indigenous ploughs, improved indigenous ploughs, mould board ploughs, disc and rotary ploughs. Secondary tillage implements: construction and function of cultivators, harrows, levelers, ridger and bund formers. Sowing and transplanting equipment: seed drills, potato planters, seedling transplanter. Inter-culture equipment: sweep. Junior hoe, weeders, long handle weeders. Crop harvesting equipments: potato diggers, fruit pluckers, tapioca puller and hoists.

**Practical:**

Calculation on force, power and energy.IC engines – showing the components of dismantled engines.Estimating the cost of tractor power.Primary and secondary tillage implements, hitching, adjustments and operations.Sowing equipment, calibration and operation. Calculation of field capacity and field efficiency of different types of primary and secondary tillage equipment.

## X. DEPARTMENT OF SOCIAL AND ALLIED SCIENCES

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | AEC 101 | Economics and Marketing | 3(2+1) |
| 2 | CSC 101 | Information and Communication Technology | 1(0+1) |
| 3 | STS 101 | Elementary Statistics | 2(1+1) |
| 4 | ENG 101 | Communication Skills and Personality Development | 1(0+1) |
| 5 | AEC 202 | Horti- Business Management | 2 (2+0) |
| 6 | AEX 301 | Fundamentals of Extension Education | 2 (1+1) |
| 7 | AEX 302 | Communication and Transfer of Technology | 2(1+1) |
| 8 | AEC 302 | Business Management and Entrepreneurship | 1(1+0) |
| 9 | AEX 303 | Agripreneurship Development and Communication Skills | 1(1+0) |
| | | **Total** | **15 (9+6)** |

**AEC 101 Economics and Marketing 3(2+1)**

**Theory**

Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption – theory of consumer behavior, 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. Meaning of Price determination and forecasting . Marketing- definition – Marketing Process – Need for marketing – Role of marketing —

Marketing functions – Classification of markets – Marketing of various channels – Price spread – Marketing Efficiency – Integration – Constraints in marketing of agricultural produce. Market intelligence. – Basic guidelines for preparation of project reports- Bank norms – Insurance – SWOT analysis – Crisis management.

**Practical**

Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Identification of marketing channel– Calculation of Price Spread – Identification of Market types – Visit to different Markets.

**CSC 101 Information and Communication Technology 1(0+1)**

**Practical**

IT and its importance. IT tools, IT-enabled services and their impact on society; computer fundamentals; hardware and software; input and output devices; binary number system; features of machine language, assembly language, high-level language and their advantages and disadvantages; principles of programming- algorithms and flowcharts; Operating systems (OS) - definition, basic concepts, introduction to WINDOWS and LINUX Operating Systems; Local area network (LAN), Wide area network(WAN), Internet and World Wide Web, HTML and IP; Introduction to MS Office - Word, Excel, Power Point. Introduction to multi-media and its application; video conferencing. Communication process, Introduction to programming languages, Introduction to 'C' programming, Primary data types and user defined data types, variables, Operators, Building and evaluating expressions, Standard library functions, Managing input and output, Decision making, Branching, Looping, Arrays and Staring function. Visual basic-concepts, ICT use in horticulture.

**STS 101 Elementary Statistics 2(1+1)**

**Theory**

Introduction to statistics, limitations of statistics.Basic concepts: Variable statistics, types and sources of data, classification and tabulation of data, construction of frequency distribution, tables, graphic representation of data, simple, multiple component and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve average and measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles and quadrilles, for raw and grouped data. Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data. Probability: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poison and normal distributions, sampling, basic concepts, sampling vs. complete enumeration parameter and statistic, sampling methods, simple random sampling and stratified random sampling. Tests of Significance: Basic concepts, tests for equality of means, and independent and paired t-tests, chi-square test for application of attributes and test for goodness of fit of Mendalian ratios. Correlation: Scatter diagram, correlation co-efficient and its properties, regression, fitting of simple linear regression, test of significance of correlation and regression coefficient.

**Practical**

Construction of frequency distribution table and its graphical representation, histogram, frequency polygon, frequency curve, bar chart, simple, multiple, component and percentage bar charts, pie chart, mean, mode for row and grouped data, percentiles, quadrille, and median for row and grouped data, coefficient of variation, 't' test for independent, will equal and unequal variants, paired 't' test, chi-square test for contingency tables and theoretical ratios, correlation and linear regression.

**ENG 101 Communication Skills and Personality Development 1(0+1)**
**Practical**

Structural Grammar: Introduction of Word Classes( eight parts of speech) ; Structure of Verb in English; Uses of Tenses; Study of Voice; Sentence Patterns in English. Spoken English: Conversations of different situations in everyday life;Reading and comprehension of general and technical articles, Mechanics of writing, writing genres, five types of writing, paragraph writing, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.Personality Development: Social manners and etiquettes, positive (rigid) attitude, report writing, letter writing (different formats and 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.

**AEC 202 Horti-Business Management 2 (2+0)**
**Theory**

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, economies of scale, returns to scale, cost of cultivation and production, break even analysis, decision making under risk and uncertainty. Farming systems and types.Budgeting as a tool for planning and control.Record keeping as a tool of control.

Planning – meaning, steps and methods of planning, types of plan, characteristics of ideal 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. Functional areas of management – operations management – physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality.Materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ).Personnel management – recruitment, selection and training, job specialization.Marketing management – definitions, planning the marketing programmes, marketing mix and four P's.Financial management – financial statements and rations, capital budgeting. Project management - project preparation evaluation measures.

**AEX 301 Fundamentals of Extension Education 2 (1+1)**
**Theory**

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Horticulture extension: process, principles and selected programmes of leading national and international forest institutes. People's participation in Horticulture programmes. Motivation of Farmers, rural youth and voluntary organizations for Horticulture extension work Rural Development: meaning, definition, objectives and genesis. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) KrishiVigyanKendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR. Communication: meaning, definition, elements and selected models. Audio – visual aids: importance, classification and selection. Adoption and diffusion process, Teaching and learning-concepts and principles, Teaching steps, Programming planning process – meaning,

scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership.ICT in Extension education, ICT use in rural India.

**Practical**

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

**AEX 302 Communication and Transfer of Technology 2(1+1)**

**Theory**

Communication, Meaning, Definition, Models, Elements and Their characteristics, types and barriers in communication.Information Communication and Technology (ICT): Meaning, definition, Importance of ICT in agriculture development, Major ICT initiatives of State and Central Government in Karnataka. ICT use in rural India. Cyber Extension : Meaning, definition , features, advantages and tools of Cyber Extension. Extension teaching methods-meaning, definition, functions and classification. Individual contact methods-farm and home visit, result demonstration, field trials-meaning, objectives, steps, merits and demerits. Group contact methods-group discussion, method demonstration, field trips-meaning, objectives, steps, merits and demerits. Small group discussion techniques-lecture, symposium, panel, debate, forum, buzz group, workshop, brain storming, seminar and conference. Mass contact methods-campaign, exhibition, kisanmela, radio and television-meaning, importance, steps, merits and demerits. Factors influencing the selection of extension teaching methods and combination (media mix) of teaching methods. tele conferences, kisan call centers, consultancy clinics. Horticultural Journalism-meaning, scope and importance, sources of news, types, merits and limitations. Diffusion and Adoption of Innovations-meaning, definition, models of adoption process, innovation- decision process-elements, adopter categories and their characteristics, factors influencing adoption process. Capacity Building of Extension Personnel and Farmers-meaning, definition, types of training, training to farmers, farm women and rural youth-FTC and KVK.

**AEC 302 Business Management and Entrepreneurship 1(1+0)**

**Theory**

Entrepreneurship Development: Assessing overall business environment in the Indian economy. 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. Export and Import Policies relevant to horticulture sector.Venture capital.Contract farming and joint ventures, public-private partnerships. Supply chain management and total quality management. Overview of horti inputs industry. Characteristics of Indian horticultural processing and export industry.Conducting market survey to the demand for product, preparing advertisements for popularization of product, Globalization and the emerging business / entrepreneurial environment.

**AEX 303 Agripreneurship Development and Communication Skills 1(1+0)**

**Theory**

Agripreneurship: meaning, definition, nature, scope, importance, types, functions and dimensions, characteristics of successful entrepreneur, approaches to entrepreneurship, Factors affecting entrepreneurial growth - psychological factors, cultural factors, socialfactors, economic factors, personality factors, strategies to motivate youths towards entrepreneurship, Risks and barriers involved in entrepreneurship, Role of entrepreneurship in economic development,Women entrepreneurship-concept, importance, problems and remedies, strategies to motivate of womenentrepreneurs.

Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs.Social Responsibility and business ethics.Government schemes and incentives for promotion of entrepreneurship.Government policy on Small and Medium Enterprises(SMEs) / SSIs.

Communication Skills: meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills, developing organizational and managerial skills, problem solving skills. field diary and lab record; indexing, footnote and bibliographic procedures, news writing, individual, group presentation, features of oral presentation, different types of presentation, evaluation of presentation, vocal communication techniques/cues, salient features of participation in seminars and conferences.

## XI. ANIMAL SCIENCE

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | **ANS 202** | **Animal Science** | 2(1+1) |
| | | **Total** | **2(1+1)** |

**ANS 202 Animal Science 2(1+1)**

**Theory**

Distribution of livestock and role in economy; Introductory animal husbandry; Breeds of livestock; Cattle, Buffalo, Sheep & Goat; Important traits, General management and feeding practices of animals; Handling of animals; Housing systems; Feed and fodders in livestock production; Common farm management practices including disinfection, isolation, quarantine and disposal of carcass; Diseases and parasite control and hygiene care.

Poultry- history and economic importance; Poultry breeds; Formation and structure of eggs; Important traits of poultry, Care and management of chicks, grower and layers/broiler; Poultry Diseases, control and hygiene care. Fishery-inland and marine fish production concepts, management, etc.

**Practical**

Visit to livestock farms/demonstration centres; Breeds of cattle, buffalo, sheep & goat; Familiarization with body parts of animals; Handling and restraining of animals; Artificial Insemination; Feeding of livestock; Methods of identification, Milking methods; Record Keeping. Visit to the Poultry farm; Poultry breeds; Body parts of chicken; Housing, equipment, Methods of identification and sexing; Identification of diseases and control of parasites, Vaccination; Maintenance of farm records.

## XII. NON LOAD COMPULSORY COURSES

| Sl. No. | Course No | Title | Credit Hour |
|---|---|---|---|
| 1 | PED 101 | Physical and Health Education-I | (0+1) |
| 2 | PED 102 | Physical and Health Education -II | (0+1) |
| 3 | NSS 201 | National Service Scheme-I | (0+1) |
| 4 | NSS 202 | National Service Scheme-II | (0+1) |
| 5 | KAN 101/ KNK 101 | Kannada-I*/ Kannada-I** | (0+1) |
| 6 | KAN 102/ KNK 102 | Kannada-II*/ Kannada-II** | (0+1) |
| 7 | HST 301 | State Study Tour | (0+1) |
| 8 | HST 402 | All India Study Tour | (0+1) |
| | | **Total** | **0+8** |

*For Kannadiga Students
** For Non Kannadiga Students

**PED 101 Physical and Health Education-I 1 (0+1) NC**

Meaning of Physical Education, Scope and importance. Foundation of physical education: Sociological and Physiological. Tournaments and competition: Definition, types of tournaments: single Knock-out and consolation, league, combination, challenge or perpetual leader and pyramid. Physical fitness and health education.Construction and lying out of the track and field.Olympics, Asian and Common Wealth and national games, *etc*.Yoga and asanas. Rules of various games-football*, basketball, Kabaddi, Badminton (ball), asanas-1and table tennis (* the girls will have tennikoit and throw ball).

**PED 102 Physical and Health Education-II 1 (0+1) NC**

Recreation and agencies promoting recreation (Agencies, Home, Government, Voluntary and Commercial). Various types of recreation: Physical activities- Minor games non equipment games, social games. Learning activities: Debates, discussions, reading etc. Acquiring activities: Hobbies like collection of stamps, coins, Creative: art and craft. Recreational facilities: personal and supervision schedule camp, picnic, social gathering, tracking rockclimbing organization of rural recreation, construction and productive recreation. Meaning of warming up; conditioning, fatigue, oxygen debt, rest and relaxation.Effect of exercises on various systems of human body. Rules of various games: cricket, volley ball, hockey, or hand ball, track and field events. Kho-Kho and asanas-II. General conditioning compulsory on all days: weight, training circuit training and calisthenics.

**NSS 201 National Service Scheme- I 1 (0+1) NC**

Introduction to National Service Scheme objectives and motto of NSS programme Planning and development, kinds of activities in regular and special camping programmes. Aspects of NSS programmeinstitutional, rural and urban projects- villages/ slum adoptionorganization and administrative arrangements of NSS at National, State University and college levels. 43 Adult education programmes of continuing education of school dropouts, coaching of students from economically weaker sections, organization of youth/ Clubs, discussions on eradication of social evils like casteism, regionalism, corruption, un-touchability, etc. nonformal education of rural youth. Awareness programmes on drug abuse and AIDS- Voter awareness campaign.

**NSS 202 National Service Scheme- II 1(0+1) NC**

Environmental enrichment and conservation, plantation of trees their preservation and up keeping. Construction of rural roads, clearing of village ponds, popularization of biogas plants, preservation of soil erosion. Programmes of work during emergencies and natural calamities like cyclones, floods and earthquake- assisting the authorities in distributions of rations, medicines and clothes-assisting health authorities in inoculation, supply of medicines etc. Reconstruction of huts, relief and rescue work. Health, family welfare and nutrition programmes, mass immunization, blood donation, integrated child development, population education- programmes aimed at creating awareness for improvement of the status of women - production oriented programmes - teaching improved Horticultural / Agricultural technologies, rodent control and pest management, weed control, soil testing, guidance in animal husbandry and poultry farming, animal health checking programmes and small savings.

***ಕನ್ನಡದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ***

**KAN 101: Kannada-I 1(0+1) NC**

**ಕಾವ್ಯ–ಕಥೆ:** d£¥zVÃvU¼Ä-d£¥zgÄ; ±gtg ªZ£U¼Ä-eÃqgzÁ¹ªÄAiÄ¸, §¸ªt, DAiÄQ ®PªÄ; gÀvVÃv-PÄªA¥Ä; CqÄU ªÄ£AiÄ ºÄqÄV- ªÉzÃ»; C«ÄÃ£¥Ägz ¸Av; º®ªÀ ªÄP¼vÁ¬Ä¨ÃgÄ-P¸Æj ¨Á»j.

**ಸಂಕೀರ್ಣ:**DºÁgªA§ DAiÄÄz-£ÁUÃ± ºUq; ¥ÆtðZAzvÃd¹–JA.JZï.PÀµAiÄ; P£ÀqzºPÀ¶ «eÁ£¸Á»vÀz GUªÄ ªÄvÄ «PÁ¸-qÁ. e.¨Á®PÀµ.

**ಸಂಸ್ಕೃತಿ ಮತ್ತುಕನ್ನಡ ಪ್ರಜ್ಞೆ:** P£ÁðlP ¸A¸ÀwAiÄMAzÄav–gºªÄvïvjPg; P£ÀqzP®¸ K£Ã£Ä DU¨ÃPÄ-qÁ.JZï.J¸ï. ²ª¥PÁ±; ¥ÁaÃ£P£Àq PÀ¶ ¸Á»vÀ– qÁ. GªiÁCQÀ.

**ಪ್ರಾಯೋಗಿಕ:** ªÀªºÁgP£Àq-¥v¯ÃR; ¥Áj¨Á¶P ¥zgZ£AiÄ «zÁ£U¼Ä.

**KAN 102: Kannada –II 1(0+1) NC**

**ಕಾವ್ಯ–ಕಥೆ –ನಾಟಕ:** d£¥zPx-d£¥zgÄ - PÀ¶ UÁzU¼Ä - d£¥zgÄ–PÄgÄqÄPÁAZt-¨ÃAz; gÆnªÄvÄ ºÄqÄV- ªÄ°PÁWAn; ¤ÃgÄ-§¸ªgÁdPÄPÀg½; ªÄÆ°P §½AiÄ ¸Äv-¥ÇtðZAzvÃd¹. v§°U¼Ä - «ÄeÁð§¶ÃgÏ

**ಸಂಕೀರ್ಣ:** £ªÄJªÄU ªiÁvÄw½AiÄÄªÀz?–UÆgÆgÄgÁªÄ¸Á«ÄCAiÄÀAUÁgï; Pg §wzÁU -d®¸ªÄ¸À - n.Dgï. C£AvgÁªiï; ¸ÁªAiÄªPÀ¶AiÄ°ªÁ¸«P «±ÃµuqÁ.n.J¸ï. Z£ÀÃ±ï.

**ಸಂಸ್ಕೃತಿ ಮತ್ತುಕನ್ನಡ ಪ್ರಜ್ಞೆ:** P£ÁðlPzPÀ¶ DZguU¼Ä - ««z ¯ÃRPgÄ; ±Á¹ÃAiÄP£ÀqCzÀiÄ£ ¸ÁzÀvU¼Ä - qÁ.£Á. VÃvÁZÁgÀ; Dq½vz°P£Àq §¼P - qÁ.P.«.£ÁgÁAiÄt.

**ಪ್ರಾಯೋಗಿಕ:** P£Àqz°PÀ¶ ¸Á»vÀ ¥PÁgU¼Ä ªÄvÄCªÀU¼gZ£Á ¸gÆ¥.

ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ

**KNK 101: Kannada –I 1(0+1) NC**

Development of listening and speaking skills with Kannada structure pattern - Introducing each other - Conversation between friends - Enquiring about family - Plan to go for a movie - Routine activities of a student - In a book shop - Introducing College/University - Conversation between a farmer and a Scientist - Data collection in a village – Conversation on going on a tour.
Development of writing and reading skills with Kannada structure pattern - Kannada Script practice and reading.

**KNK 102 Kannada –II 1(0+1) NC**

Development of listening and speaking skills with Kannada structure pattern - Conversation between a Doctor and a Patient; About Children's Education; Halebid-Belur; Discussing about Examination and Future Plan.
Development of writing and reading skills with Kannada structure pattern : Translation of simple sentences English into Kannada, Selected lesson for reading (Nada Geete, Kannada Habbagalu, PrekshaniyaSthalagalu, Kannada Kavi, Kannada Vignani)

**HST 301 State Study Tour (0+1)**

Visits to national/state research institutes or centers, visit to state extension centers, visit to state Agril. Universities, visit to Govt./Private seed/processing industries, visit to progressive farmers fields.

**HST 402 All India Study Tour (0+1)**

Visits to national/state research institutes or centers, visit to state extension centers, visit to state Agril. Universities, visit to Govt./Private seed/processing industries, visit to progressive farmers fields.

## XIII. Students READY (Rural and Entrepreneurship Awareness Development Yojana)

| Sl. No | Course No | Title | Credit Hours |
|---|---|---|---|
| 01 | HEL 401 | ExperientialLearning in Horticulture | 0+20 |
| 02 | RHWE 402 | Rural Horticultural Work Experience | 0+20 |
| | | **Total** | **0+40** |

**HEL 401 Experiential Learning in Horticulture (0+20)**
**[Each module 10 (0+10)]**

Students will practically gain hands on expertise for a semester in **any two** options out of commercial horticulture, protected cultivation of high value horticulture crops, processing of

fruits and vegetables for value addition, floriculture and landscape architecture, production of bioinputs-biofertilizers and biopesticides, mass multiplication of plants and bio-molecules through tissue culture, mushroom culture and bee keeping. In one semester students will be working with horticulture farmers/horticulture based industries in collaboration with developmental departments, extension functionaries, input suppliers, marketing and procurement functionaries, processing industries.

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

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

3. **Module-III. Processing of Fruits and Vegetables for Value Addition**: Planning and execution of a market survey, preparation of processing schedule, preparation of project module based on market information, calculation of capital costs, source of finance, assessment of working capital requirements and other financial aspects, identification of sources for procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale, packaging, labelling, pricing and marketing of product.

4. **Module-IV. Floriculture and Landscape Architecture:** Preparation of project report, soil and water analysis, preparation of land and layout. Production and Management of commercial flowers. Harvesting and postharvest handling of produce. Marketing of produce, Cost Analysis, Institutional Management, Visit to Flower growing areas and Export House, Attachment with private landscape agencies. Planning and designing, site analysis, selection and use of plant material for landscaping. Formal and informal garden, features, styles, principles and elements of landscaping. Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues. Making of lawns, use of software in landscape. Making of bouquets, button hole, wreath, veni and gazaras, car and marriage palaces. Dry flower Technology (identification of suitable species, drying, packaging and forwarding techniques).

5. **Module-V. Bio-inputs: Bio-fertilizers and Bio-pesticides**: Isolation and pure culture establishment of fertilisers and bio-pesticides. Culture methods and substrates. Scale of methods for bio-fertilizers and bio-pesticides. Substrate preparation and mixing techniques. Quality analysis of bio-fertilizers and bio-pesticides. Testing the final product in small scale level. Storage, marketing and cost analysis of bio-fertilizers and pesticides.

6. **Module-VI. Mass Multiplication of Plants and Molecules through Tissue Culture**
   Preparation of stock solutions of tissue culture media.Preparation of solid media and liquid media.Initiation of in vitro culture and multiplication (preparation of explant, inoculation and culturing) (crop to be selected). Sub-culturing, Rooting, Hardening and establishment, Initiation of callus cultures – suspension cultures, Induction of selected biomolecules in callus, Harvesting and extraction of biomolecule, Marketing and cost analysis.

7. **Module-VII. Mushroom Culture**: Construction cultivation room/structure and Disinfection. Compost preparation & pasteurization. Procurement of mother culture and spawn preparation. Procurement of casing soil and preparation for production. Mushroom seeding, Casing with soil and maintenance, Harvesting, processing, Grading, packing, marketing and Cost economics of mushroom culture.

8. **Module-VIII. Bee keeping**: Procurement and arrangement of bee keeping equipments. Location and collection of potent nectar yielding bee flora seeds from wild. Raising/ enriching the high nectar yielding bee flora in the campus. Location and hiving the natural bee colony from the wild. Establishing the apiary with suitable/favourable necessaries. Maintenance and multiplication of hived colonies. Management of natural enemies and diseases of bees. Maintenance of bee colonies during dearth and honey flow seasons. Harvesting and Processing of honey and bee wax. Marketing and cost analysis.

9. **Module-VII. Seed Production Annual Horticulture Crops.**
   Book keeping of records and accounts, market demand of crop Varieties.Seed classes and its standards. Varieties and hybrid seed production techniques of okra / chilli, / tomato / brinjal/ onion, palak, coriander *etc* and their maintenance. Field inspections and harvesting.Seed processing techniques. Seed quality testing. Seed treatment, packaging, storage and marketing. Visit to farmer's seed production plots, public and private seed industries. Visit to Seed Processing Units/ Seed Testing Laboratory /Seed ware houses/ Cold storage units, *etc*. Economics of Seed Production.Report writing and submission.

**RHW 402 Rural Horticultural Work Experience (0+20)**

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

| Sl. No | RHWE Programme | Duration |
|---|---|---|
| 1 | Orientation programme | 2 week |
| 2 | Village stay at RSK/ Hobli level | 12 weeks |
| 3 | All India study tour | 2 weeks |
| 4 | Placement Programme | 5 weeks |
| 5 | Report writing & final examination | 3 weeks |
| | **Total** | **24 weeks** |

**1. Horticultural Extension Education & Project Work: 0+5**

Extension programme planning and Execution, Leadership in rural areas and identification of leaders to use in Extension work, Participatory Rural Appraisal (PRA) techniques for efficient extension work, Extension teaching methods like General meeting, Farm and Home Visit, Group discussion meeting, Method Demonstration, Result Demonstration, Campaign, Farmers Training, Exhibition, Field Visits, Field days, Community work *etc*.

**2. Vegetable Science: 0+1**

Identifying the important commercial crops of the areas, their management practices followed by the farmers and gaps with new technologies, identification of under exploited vegetables of the area and creating awareness of their production potentiality, introduction of new non-traditional vegetable crops, establishment of nutritional gardens to the villagers, commercial vegetable nurseries, possibilities for introducing high-tech vegetable production systems.

**3. Fruit Science: 0+1**

Identifying the important fruit crops of the area and their orchard, layout and management, identification of problems associated with production, protection and marketing, including post-harvest management and processing. Possibilities of introducing new fruit crops suited to the areas.

**4. Post-Harvest Technology: 0+1**

Creating awareness programme of the losses due to present post harvest practices followed by the farmers. Creating awareness on storage of commercial horticultural produce. Demonstration with respect to value addition to the horticultural produce of the area (Jam, Jelly, Ketchup, Syrups & RTS).

**5. Floriculture and Landscape Architecture: 0+1**

Identifying the important commercial flower crops of the area and their production and management practices followed by the farmers. Creating awareness for improved practices of these flower crops to boost production both under open and protected conditions Demonstration of landscaping to the public premises like schools, temples, offices etc. Possibility of value addition and flower display, exhibition and flower arrangement for the locally important flower crops.

**6. Medicinal and Aromatic Crops: 0+1**

Identifying the important medicinal and aromatic crops suited to the area and demonstrating their production and management practices creating awareness for introduction of new medicinal and aromatic crops suited to the area processing methods of aromatic and medicinal crops.

**7. Spices and Plantation Crops: 0+1**

Identifying the important spice and plantation crops suited to the area and demonstrating their production and management practices, creating awareness for popularization the new spice crops

and plantation crops suited to the areas for increasing production potentiality of these crops. Demonstrating the processing methods of spice crops of the area to the farmer, value added products of plantation crops and their demonstration.

**8. Entomology: 0+1**

Identification of local pest situations and pest management practices; Different types of nonchemical inputs used in pest management, Seed treatment with pesticides; Storage practices of farm produces to prevent insect damage; Local and traditional practices of pest management; Assessment of pest and natural enemy densities; Surveillance of pest and natural enemies, Importance of keeping record of purchases of the insecticides; Sources of information available for plant protection practices; Preparation of spray solution: Calculation of spray Volume; Harvesting and processing local plants and their products for pest management practices; Preparation of NSKE, vegetable oils and other plant sources and NPV; Use of pheromone traps for pest monitoring; Safe handling of pesticides and field release of parasites and predators; Use of nylon nets in nurseries; Root feeding and/ or stem Injection of pesticides; fumigants; rodent management. Apiculture, importance in crop pollination colony management and honey and byproducts.

**9. Plant Pathology: 0+1**

Plant disease details for major crops- a) Important diseases and their severity, b) Collection of diseased plants and plant parts; Disease management practices and their frequency; Use of fungicides, bactericides, antibiotics; Different types of non-chemical inputs used; Sources of information on plant protection practices. Information regarding storage practices; Information on conventional or local practices of disease management; storage practices; Types of sprayers/dusters and their availability; Preparation of Bordeaux mixture; Cultural and biological management of soil borne disease; Seed treatment with fungicides/antibiotics; Preparation of spray solutions, proprietary fungicides and their application; Calculations of spray volume requirement –Preparation of NSKE and vegetable oils for spraying; Use of nylon nets in nurseries; Use of biological agents; Root feeding of fungicides; Hot water treatment and furadon or thimet application against nematodes.

**10. Soil Science and Agril. Chemistry: 0+1**

Collection and preparation of soil and water samples for analysis and recommendation based on results of analysis; STCR based methods of fertilizer application; Identification and amelioration of saline, sodic and acidic soils; Identification of nutrient deficiency/toxicity symptoms in crops and recommendations to rectify the problems, utilization of organic wastes; integrated nutrient management; Enhancement of fertilizer use efficiency, preparation of slow release fertilizers by using neem cake coated and gypsum blended urea; Scientific methods of enrichment of FYM by using weeds, rock phosphate and micronutrients.

**11. Agronomy: 0+1**

Collection of meteorological data, production of organic manures- selection of site for FYM/compost pit, FYM, different methods of compost production, vermicompost, liquid manures, oil cakes, green manuring in dryland agriculture, fertilizer management including secondary and micronutrients, integrated nutrient management, site specific nutrient management, integrated weed management, watershed management, soil and water conservation, integrated farming system, water management including micro irrigation, aerobic rice production, non-cash and low-cost inputs for crop production.

**12. Agricultural Economics: 0+1**

Introductory economic principles of practical application in micro one macro level problems faced by farmers in agriculture; Cost effectiveness of different agricultural technologies; Costing/ Valuing inputs including natural resources used in agriculture; Relative profitability of crops, livestock, horticulture, fishery enterprises; Risks and uncertainties involved in cultivation and marketing and mitigation strategies; Economic efficiency; Gaps in efficiency, productivity and how to address them. Problem statement in lay person's terms. Problem restated in economic terminology. The broad subject matter area which best describes the economic problem (classification of the problem) Gaps between targets and achievement and factors facilitating (Ex. Access to quality inputs and markers) solutions at farm Solutions at program/policy levels. Apprising the selected farmers regarding the economic solutions to the problems identified covering economic efficiency, pricing, marketing, group marketing, backward and forward linkages, new enterprises, synergies, diversification, risk aversion strategies.

Concept of Agricultural Marketing, Significance of Marketing, Marketing function, Physical, Exchange and facilitative, Different types of Agricultural Markets, Methods of Sales of Agricultural Commodities, APMC & their objectives, Different Government Schemes in Agricultural Marketing, Marketing Institutions. Grading of Agricultural Commodities, Importance, Types, Scientific Marketing of Agricultural Commodities, Standards for Manufacture, Recent Advances in Agricultural Marketing.

**13. Seed Science and Technology: 0+1**

Different sources of seed and their characteristics (BS, FS, CS and TL seeds). Status of Seed replacement in RHWE villages (vegetables, flowers, Fruit and spices crops).Involvement of seed producing organization in seed production; Government sector, Private sector, Co-operative sector. Techniques followed in seed production: Hybrid, High yielding varieties and horticulture crops. Post harvest technology followed in seed crops: Method of harvest, Method of threshing. Method of pre-cleaning, Method of drying and packing, Analysis of post harvest losses at various levels. Analysis of seed quality of farmers saved seed: Collection of seed from farmer, Subjecting for seed quality parameters like G, P, M, Result communication. Demonstration of different class of seed and their identification: Breeder seed, Foundation seed, Certified seed, Truth fully labeled seed. Visit to seed processing unit: Study various activities, Involving in processing operations like grading, cleaning, storage, treating, packaging etc. Seed treatment techniques.Seed marketing and seed distribution system.

**14. Biotechnology and Crop Improvement/ Crop Physiology 0+1**

Introduction of latest hybrids/ varieties suited to the area. Advantages of tissue culture techniques and their practical utility with respect to horticultural crops.I.P.R. issues, and farmers right.

Nutrient elements and their importance in growth and development of crops.Deficiency and toxicity symptoms and their identification in the field and corrective measures.Foliar nutrition.Plant growth regulators and their role in plant growth and development.Use of plant growth regulators in agriculture, horticulture, forestry and industry. Demonstration of use of plant growth regulators to induce rooting of cuttings, induction of regular flowering prevent/reduce flower and fruit drops, increase in fruit size breaking seed, dormancy, fruit ripening. Importance of seed hardening and demonstration.

**15. Agril Engineering: 0+1**

Study on improved primary and secondary tillage implements, improved seed drill, seed-cum-fertilizer drill, planters and transplanters, improved intercultural implements like hoes, hand weeder and ridger, high-tech plant protection equipments like sprayers and dusters, improved sickles, harvesters and reapers; power operated winnowers, threshers; dryers, cleaners, graders and improved storage bins, coconut climbers, coconut dehusker, groundnut decorticator, arecanut decorticators and maize sheller, soil and water conservation structures.

**16. Agril Microbiology: 0+1**

Biofertilizers usage in different crops: a) *Rhizobium* inoculation in leguminous cops b) *Azotobacter* inoculation in cereals c) *Azospiriullum* inoculation in paddy and ragi d) *Gluconobacter* inoculation in sugarcane e) Use of phosphorus solubilizing microorganisms in crop production f) Azolla and its cultivation, its importance in agriculture and husbandry g) PGPR microorganisms, AM fungi and their importance in agriculture. Use of biofertilizers in horticulture and sericulture crops Mushroom cultivation, fast organic matter decomposers and compost enriching microbes. Microbial bio-control agents like *Trichoderma*spp, Pseudomonas spp and Bacillus spp.

# Proposed Semester-wise Courses

## I Semester

| Sl. No | Course No | Course TITLE | Credit Hours |
|---|---|---|---|
| 1 | STS 101 | Elementary Statistics | 2(1+1) |
| 2 | SAC 101 | Fundamentals of Soil Science | 2(1+1) |
| 3 | CSC 101 | Information and Communication Technology | 1(0+1) |
| 4 | AEC 101 | Economics and Marketing | 3(2+1) |
| 5 | PHT 101 | Fundamentals of Food and Nutrition | 2(1+1) |
| 6 | BCH 101 | Elementary Plant Biochemistry | 2(1+1) |
| 7 | CPH 101 | Introductory Crop Physiology | 2(1+1) |
| 8 | FSC 101 | Fundamentals of Horticulture | 3(2+1) |
| 9 | ENG 101 | Communication Skills and Personality Development | 1(0+1) |
| 10 | AMB 101 | Fundamentals of Microbiology | 2(1+1) |
| 11 | PED 101 | Physical and Health Education-I | 1(0+1 NC) |
| 12 | KAN-101 | Kannada – I * | 1(0+1 NC) |
| | KNK-101 | Kannada – I** | |
| | | **Load** | **20 (10+10)** |
| | | **Non Load** | **2 (0+2)** |
| | | **Total** | **22 (10+12)** |

*For Kannadiga Students
** For Non Kannadiga Students

## II Semester

| Sl. No | Course No | Course TITLE | Credit Hours |
|---|---|---|---|
| 1 | VSC 102 | Tropical and Sub Tropical Vegetables | 3(2+1) |
| 2 | FLA 102 | Ornamental Horticulture | 2(1+1) |
| 3 | PMA 102 | Plantation Crops | 3(2+1) |
| 4 | PAT 102 | Fundamentals of Plant Pathology | 3(2+1) |
| 5 | ENT 102 | Fundamentals of Entomology | 2(1+1) |
| 6 | FSC 102 | Plant Propagation and Nursery Management | 2(1+1) |
| 7 | CPH 102 | Growth and Development of HorticultureCrops | 2(1+1) |
| 8 | GPB 102 | Principles of Genetics and Cytogenetics | 3(2+1) |
| 9 | AEG 102 | Surveying, Soil and Water Conservation | 1(0+1) |
| 10 | PED 102 | Physical and Health Education -II | 1(0+1 NC) |
| 11 | KAN-102 | Kannada – II * | 1(0+1 NC) |
| | KNK-102 | Kannada – II** | |
| | | **Load** | **21(12+9)** |
| | | **Non Load** | **2 (0+2)** |
| | | **Total** | **23(12+11)** |

*For Kannadiga Students
** For Non Kannadiga Students

## III Semester

| Sl. No | Course No | Course TITLE | Credit Hours |
|---|---|---|---|
| 1 | SAC 201 | Soil, Water and Plant Analysis | 2(1+1) |
| 2 | FLA 201 | Commercial Floriculture | 2(1+1) |
| 3 | PMA 201 | Spices and Condiments | 2(1+1) |
| 4 | VSC 201 | Temperate Vegetables and Tuber Crops | 3(2+1) |
| 5 | GPB 201 | Principles and Methods of Plant Breeding | 3(2+1) |
| 6 | ENT 201 | Principles of Pest Management and Productive Insects | 3(2+1) |
| 7 | PAT 201 | Diseases of Fruit, Plantation, Medicinal and Aromatic Crops | 3(2+1) |
| 8 | FSC 201 | Tropical and Sub tropical Fruits | 3(2+1) |
| 9 | AGR 201 | Water Management in Horticulture Crops | 2(1+1) |
| 10 | NSS 201 | National Service Scheme-I | 1(0+1 NC) |
| | | **Load** | **23(14+9)** |
| | | **Non Load** | **1(0+1)** |
| | | **Total** | **24(14+10)** |

## IV Semester

| Sl. No | Course No | Course TITLE | Credit Hours |
|---|---|---|---|
| 1 | FLA 202 | Landscape Architecture | 2(1+1) |
| 2 | PMA 202 | Medicinal Crops | 2(1+1) |
| 3 | VSC 202 | Precision Farming and Protected Cultivation of Vegetables | 1(0+1) |
| 4 | SST 202 | Principles of Seed Production in Horticulture Crops | 2(1+1) |
| 5 | FSC 202 | Temperate Fruit Crops | 2(2+0) |
| 6 | PBT 202 | Introduction to Plant Biotechnology | 2(1+1) |
| 7 | AGR 202 | Agro-meteorology and Climate Change | 2(1+1) |
| 8 | ENS 202 | Environmental Studies and Disaster Management | 2(2+0) |
| 9 | AMB 202 | Soil and Applied Microbiology | 2(1+1) |
| 10 | AEC 202 | Horti-Business Management | 2(2+0) |
| 11 | AEG 202 | Farm Power and Machinery | 2(1+1) |
| 12 | ANS 202 | Animal Science | 2(1+1) |
| 13 | NSS 202 | National Service Scheme-II | 1(0+1 NC) |
| | | **Load** | **23(14+9)** |
| | | **Non Load** | **1(0+1)** |
| | | **Total** | **24(14+10)** |

## V Semester

| Sl. No | Course No | Course TITLE | Credit Hours |
|---|---|---|---|
| 1 | AGR 301 | Major Field Crops | 2(1+1) |
| 2 | FLA 301 | Protected Cultivation of Flower Crops | 2(1+1) |
| 3 | ENT 301 | Pests of Vegetable, Ornamental and Spice Crops | 2(1+1) |
| 4 | PHT 301 | Post Harvest Management of Horticultural produce | 3(2+1) |
| 5 | AEX 301 | Fundamentals of Extension Education | 2(1+1) |
| 6 | PMA 301 | Aromatic Crops | 2(1+1) |
| 7 | FSC 301 | Dryland Horticulture | 2(1+1) |
| 8 | VSC 301 | Breeding and Seed Production of Vegetable Crops | 3(2+1) |
| 9 | PAT 301 | Diseases of Vegetable, Ornamental and Spice Crops | 3(2+1) |
| 10 | VSC 302 | Experimental Techniques in Horticulture | 1(0+1) |
| 11 | HST 301 | State Study Tour | 1(0+1 NC) |
| | | **Load** | **22** (12+10) |
| | | **Non Load** | 1(0+1) |
| | | **Total** | **23 (12+11)** |

## VI Semester

| Sl. No | Course No | Course TITLE | Credit Hours |
|---|---|---|---|
| 1 | PMA 302 | Breeding of Spice andPlantation Crops | 2(1+1) |
| 2 | FLA 302 | Breeding and Seed Production of Flower Crops | 2(1+1) |
| 3 | SAC 302 | Soil Fertility and Nutrient Management | 2(1+1) |
| 4 | AEX 302 | Communication and Transfer of Technology | 2(1+1) |
| 5 | ENT 302 | Pests of Fruit, Plantation, Medicinal and Aromatic Crops | 3(2+1) |
| 6 | PHT 302 | Processing of Horticultural Produce | 3(2+1) |
| 7 | FSC 302 | Breeding of Fruit Crops | 2(1+1) |
| 8 | AGR 303 | Weed Management in Horticulture Crops | 1(0+1) |
| 9 | AEC 302 | Business Management and Entrepreneurship | 1(1+0) |
| 10 | AEX 303 | Agripreneurship Development and Communication Skills | 1(1+0) |
| 11 | AGR 302 | Organic Farming | 2(1+1) |
| 12 | FOR 302 | Introductory Agro-forestry | 2(1+1) |
| | | **Total** | **23(13+10)** |

## VIISemester

| Sl. No | Course No | Course TITLE | Credit Hours |
|---|---|---|---|
| **Students READY** | | | |
| | **HEL 101** | **Experiential Learning in Horticulture *** | **20(0+20)** |
| 1 | HEL 401 | Commercial Horticulture | |
| 2 | HEL 401 | Protected Cultivation of High Value Horticulture Crops | |
| 3 | HEL 401 | Processing of Fruits and Vegetables for Value Addition | |
| 4 | HEL 401 | Floriculture and Landscape Architecture | |
| 5 | HEL 401 | Bio-Inputs : Bio-fertilizers and Bio-pesticides | |
| 6 | HEL 401 | Mass Multiplication of Plant Molecules through Tissue Culture | |
| **7** | HEL 401 | Mushroom Culture | |
| 8 | HEL 401 | Bee Keeping | |
| 9 | HEL 401 | Seed Production of Annual Horticulture Crops | |
| | | **Total** | **20(0+20)** |

**Note:** * Students can select any **two modules**.

## VIII Semester

| Sl. No | Course No | Course title | Credit Hours |
|---|---|---|---|
| **Students READY** | | | |
| 1 | RHW 402 | Rural Horticultural Work Experience | 0+20 |
| 2 | HST 402 | All India Study Tour | 0+1 NC |
| | | **Load** | **20(0+20)** |
| | | **Non Load** | **0+1** |
| | | **Total** | **21(0+21)** |
| | | **Grand Total** | **172+8**** |

**Note:** ** Non Load Compulsory Course

## EXAMINATION AND EVALUATION SYSTEM

Fifth Deans' Committeedeliberated on the examination and evaluation system being followed by different universities. The Committee recommends uniform grading system to be followed with uniform OGPA requirements for award of degrees at all levels and uniform conversion formulae to be followed for declaration of I, II and III divisions, distinctions etc. Declaration of division in the degree certificate to be made compulsory.

**1. Examination**

External theory (50%)
Internal Theory + Practical (50%)

- **Courses with Theory and Practical**
  Mid-term Exam (25%) + Attendance (5%) + Assignment (5%) + Practical test (10%) and record (5%)

- **Courses with only Theory**
  Mid-term Exam (40%) + Attendance (5%) + Assignment (5%)

- **Courses with only Practical**: (100%) Internal:
  Mid-term Practical Exam (40%) + Final Practical Test (40%)+ Practical Record (10%) +Attendance (5%) + Assignment (5%)

- **General instructions**
  - Paper to be set by external: HOD shall ensure the coverage of syllabus. If needed moderation can be done.
  - Evaluation to be done **i**nternally by the faculty who offers the Course.
  - Syllabus of the concerned course shall be sent to the external examiner, who shall prepare the question papers.
  - For practical, the examination shall be conducted by course teacheralong with one teacher nominated by Dean of the college.

**2. Evaluation**

| Degree | Percentage of Marks Obtained | Conversion into Points |
|---|---|---|
| All | 100 | 10 Points |
| | 90 to <100 | 9.00 to <10.00 |
| | 80 to <90 | 8.00 to <9.00 |
| | 70 to <80 | 7.00 to <8.00 |
| | 60 to <70 | 6.00 to <7.00 |
| | 50 to <60 | 5.00 to <6.00 |
| | <50 (Fail) | <5.00 |
| | Eg. 80.76 | 8.08 |
| | 73.60 | 7.36 |

**Note:** Credit points will be calculated after converting the grade point in to two decimal points.

| **OGPA** | **Division** |
|---|---|
| 5.00 – 5.99 | Pass |
| 6.00 – 6.99 | II division |
| 7.00 – 7.99 | I division |
| 8.00 and above | I division with distinction |

GPA = Total points scored / Total credits (for 1 semester)
CGPA = ∑ Total points scored / Course credits
OGPA = ∑ Total points scored (after excluding failure points)/ Course credits
% of Marks = OGPA x 100/10