Floriculture & Landscaping

Principles of Landscape Architecture

Historical Importance of Indian gardens, Gardens of ancient world, Definitions, Famous gardens of India and abroad, formal, informal, free style and wild gardens, basic themes of gardens *viz.* circular, rectangular and diagonal themes, Steps in preparation of garden design, Use of AutoCAD and ArchiCAD in designing gardens. Factors affecting landscape design *viz.* intial approach, view, human choice, simplicity, topography etc.

Principles of Landscape gardens *viz.* Axis, rhythm, balance, time and light, space, texture, form, mass effect, focal point, mobility, emphasis, unity and harmony etc.

Elements of landscape gardens *viz.* tangible and intangible elements, Bio-aesthetic planning, definition, objectives, Planning and designing of home gardens, colonies, country planning, urban landscape, development of institutional gardens, planning and planting of avenues, beautifying schools, railway lines, railway stations, factories, bus stands, air ports corporate buildings, dams, hydro electric stations, river banks, play grounds, Gardens for places of religious importance viz. temples, churches, mosques, tombs etc, Importance, features and establishment of English garden , Japanese gardens , Mughal, gardens, French and Persian garden, Italian gardens, Hindu gardens and Buddhist gardens, Xeriscaping, definition, principles and practice

Commercial Floriculture

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

Ornamental Horticulture

History, definitions, scope of ornamental horticulture, aesthetic values, Floriculture industry, Importance, area and production, industrial importance of ornamental plants and flowers

Importance, classification, design values and general cultivation aspects for ornamental plants viz. Annuals, biennales herbaceous perennials, grasses and bulbous ornamentals, shrubs, climbers, trees, indoor plants, palms and cycads, ferns and selaginellas, cacti and succulents

Importance, design and establishment of garden features/components *viz.* hedge, edge, borders, flower beds, bridges, paths, drives, fences, garden walls, gates, carpet bed, arbour, Patio, decking, retaining walls, shade garden, sunken garden, roof garden, terrace garden, pebble garden, rockery, pools, waterfalls, fountains, bog garden, avenue planting and children garden

Lawn types, establishment and maintenance, importance of Garden adornments *viz.* floral clock, bird bath, statutes, sculptures, lanterns, water basins, garden benches etc.

Importance of flower arrangement, Ikebana, techniques, types, suitable flowers and cut foliage, uses of vertical garden, bottle garden, terrariums, art of making Bonsai, culture of Bonsai and maintenance

Breeding and Seed Production of Flower and Ornamental Crops

History of improvement of ornamental plants, Centre of origin of flower crops and ornamental crops, objectives and techniques in ornamental plant breeding

Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops *viz.*, Rose, Jasmine, Chrysanthemum, Tuberose, Gerbera, Gladiolus, Dahlia, Lilium, Petunia, Hibiscus, Bougainvillea, Crossandra, Marigold, Geranium, Snapdragon, China Aster, Orchids, Anthurium, Carnation, Hibiscus etc.

Breeding for disease resistance

Development of promising cultivars of important ornamentals and flower crops

Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility

Production of open pollinated seed, Harvesting processing and storage of seeds of ornamental crops, seed certification

Fruit Science

Scope and importance, classification of horticultural crops and nutritive value, area and production, exports and imports, Horticultural zones of India and different states. Principles, planning and layout, management of orchards, planting systems and planting densities. 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. Factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, principles of organic farming. self-incompatibility, use of pollinisers, re-plant problem.

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy types of dormancy (scarification & stratification). Nursery management, apomixes – mono-embrony, polyembrony, chimera& bud sport. Propagation Structures. Nursery tools and implements, types and stages of seed germination with examples. Classification and discussion on vegetative propagation, (specialized organs: corm, runners, suckers, division-stolons, pseudobulbs, offsets, Cutting, Layering, Grafting, Budding etc). 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, Micrografting, meristem culture, callus culture, anther culture, organogenesis, somaclonal variation hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery.

Orchard and estate management, importance, objectives, merits and demerits, Cropping systems, intercropping, multi-tier cropping, mulching– objectives, types merits and demerits,

clean cultivation, sod culture, Sod mulch, herbicides and mulches. Integrated nutrient and pest management.

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, scarce 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. 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 fruit crops suitable for arid climates.

Detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning, management of water, nutrient and weeds, special horticultural techniques, physiological disorders, disease, pest management, post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of tropical, subtropical and temperate fruit and nut crops.

Fruit breeding - History, importance in fruit production, distribution, domestication and adaptation of commercially important fruits, variability for economic traits, breeding objectives, breeding strategies and problems, introduction, clonal selection, hybridization, bud mutations, polyploidy, biotechnological interventions and its application in crop improvement and achievements.

Post-Harvest Management

Importance of Postharvest Technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, spices, medicinal and aromatic plants. Pre-harvest factors affecting quality, factors responsible for deterioration of horticultural produce, physiological and bio-chemical changes, ripening and changes occurring during ripening; hastening and delaying ripening process. Postharvest treatments of horticultural crops. Quality parameters and specifications. Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. Methods of storage for local market and export. Pre-harvest treatment and pre-cooling, pre-storage treatments. Storage: different systems of storage (ZECC, cold storage, CA, MA, and hypobaric). Packaging methods and types of packages, recent advances in packaging. Types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments. Modes of transport. Market chain management.

Importance and scope of fruit and vegetable preservation industry in India, extent and possible causes of post-harvest losses. Status of food processing industries in India and abroad, magnitude and inter- dependence of dairy and food industry, prospects for future growth in India. Harvesting, transportation and storage of fruits and vegetables. *Post-harvest processing of fruits and vegetables:* Peeling, sizing, blanching, Canning of fruits and vegetables, Drying and freezing of fruits and vegetables. *Juice processing*: General steps in juice processing, role of enzymes in fruit. Juice extraction, equipments and methods of fruit juice extraction, preservation of fruit juices, fruit juice

clarification, concentration of fruit juices, fruit juice powders. Fruit juice processing; Orange and tangerine, Lemon and lime juice, Apple juice, Grape juice, Nectars, pulpy juices, tropical blends, Vegetable juices. *Manufacture of Jam, Jelly and Marmalade*: Role played by pectin, sugar and acid in jellied fruit products. Fruits and vegetable preserves, Glazed, Crystallized fruits. Tomato based products: Juice, puree, paste, sauce, ketchup. Pickles: Principle of pickling, technology of pickles. *Beverages:* Classification, scope, carbonated non-alcoholic beverages and their manufacture. Fruit beverages and drinks, additives for fruit based beverages. Coffee processing including roasting, grinding, brewing extraction, dehydration, aromatization, instant coffee. *Tea:* Tea leaf processing, green, red, yellow, instant tea. Fermented and non-fermented beverages.

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

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

VEGETABLE SCIENCE

1. Tropical and Sub-Tropical Vegetables 3(2+1)

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield and seed production. Economic of cultivation of tropical and sub-tropical vegetable crops; post-harvest handling and storage. Marketing of tomato, brinjal,

chillies, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca and basella.

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

2. Breeding of Vegetable, Tuber and Spice Crops 3(2+1)

Centres of origin, plant bio-diversity and its conservation. Models of reproduction, pollination systems and genetics of important vegetable, tuber and spice crops. Self-incompatibility and male sterility, its classification and application in crop improvement. Principles of breeding self-pollinated crops, pure line selection, mass selection, heterosis breeding, hybridization, pedigree method, mass pedigree method, bulk method, modified bulk method, single seed descent method and back cross method. Polyploidy breeding. Mutation breeding. Principles of breeding cross pollinated crops, mass selection, recurrent selection, heterosis breeding, synthetics and composits. Application of biotechnology in crop improvement. Crops: Solanaceous vegetables, cole crops, cucurbits, bulb crops, root crops, leafy vegetables, okra, leguminous crops.

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

3. Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

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

production. Methods of seed production of cole crops, root vegetables, solanaceous vegetables, cucurbits, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables. Seed germination and purity analysis. Field and seed standards. Seed drying and extraction. Seed legislation**.**

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

4. Temperate Vegetables **2(1+1)**

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

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

5. Potato and Tuber Crops 2(1+1)

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

Practical: Identification and description of potato and tropical, sub-tropical and temperate tuber crops; planting systems and practices; field preparation and sowing/planting. Top dressing of fertilizers and interculture and use of herbicides and growth regulators;

identification of nutrient deficiencies, physiological disorders; harvest indices and maturity standards, post-harvest handling and storage, marketing. Seed collection, working out cost of cultivation, project preparation of commercial cultivation.

PLANTATION, SPICES, MEDICINAL & AROMATIC CROPS

PSMA 501 PRODUCTION TECHNOLOGY OF PLANTATION CROPS 3(2+1)

Objective

To impart basic knowledge about the importance and production technology of plantation crops grown in India.

Theory

Role of plantation crops in national economy, export potential, IPR issues, clean development mechanism, classification and varietal wealth. Plant multiplication including *in vitro* multiplication, systems of cultivation, multitier cropping, photosynthetic efficiencies of crops at different tiers, rainfall, humidity, temperature, light and soil pH on crop growth and productivity, high density planting, nutritional requirements, physiological disorders, role of growth regulators and macro and micro nutrients, water requirements, ferti-gation, moisture conservation, shade regulation, weed management, training and pruning, crop regulation, maturity indices, harvesting. Cost benefit analysis, organic farming, management of drought, precision farming.

Crops

Cashew, Rubber, Palmyrah, Oil palm, Coconut, Arecanut and Betel vine

Practical

Description of botanical and varietal features, selection of mother palms and seedlings in coconut and arecanut, soil test crop response studies and manuring practices, pruning and training, maturity standards, harvesting, Project preparation for establishing plantations, Visit to plantations.

PSMA 502 PRODUCTION TECHNOLOGY OF PLANTATION (BEVERAGE) CROPS 1 + 1

Theory

Role of plantation crops in national economy, export potential, IPR issues, clean development mechanism, classification and varietal wealth. Plant multiplication including *in vitro* multiplication, systems of cultivation, multitier cropping, photosynthetic efficiencies of crops at different tiers, rainfall, humidity, temperature, light and soil pH on crop growth and productivity, high density planting, nutritional requirements, physiological disorders, role of growth regulators and macro and micro nutrients, water requirements, ferti-gation, moisture conservation, shade regulation, weed management, training and pruning, crop regulation,

maturity indices, harvesting. Cost benefit analysis, organic farming, management of drought, precision farming.

Crops

Coffee, Tea, Cocoa

Practical

Description of botanical and varietal features, selection of mother palms and seedlings in coconut and arecanut, soil test crop response studies and manuring practices, pruning and training, maturity standards, harvesting, Project preparation for establishing plantations, Visit to plantations.

PSMA 503 PRODUCTION TECHNOLOGY OF MAJOR SPICE CROPS 1+1

Objective

To impart basic knowledge about the importance and production technology of spices grown in India.

Theory

Introduction, importance of spice crops-historical accent, present status - national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, site selection, layout, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of:

Crops

Black pepper, Cardamom, Turmeric, Ginger, Chilli, Onion

Practical

Identification of seeds and plants, botanical description of plant; preparation of herbarium, propagation, nursery raising, field layout and method of planting, cultural practices, harvesting, drying, storage, packaging and processing, value addition; short term experiments on spice crops.

PSMA 504 PRODUCTION TECHNOLOGY OF MINOR, SEED AND TREE SPICE CROPS 2+1

Theory

Introduction, importance of spice crops-historical accent, present status - national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, site selection, layout, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures and seed planting material and micro-

propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of:

Crops

Clove, Cinnamon and Nutmeg, Allspice, Garlic, Coriander, Fenugreek, Cumin, Fennel, Ajowain, Dill, Celery,Tamarind, Garcinia and Vanilla

PSMA 505 PRODUCTION TECHNOLOGY FOR MEDICINAL AND AROMATIC CROPS 1 + 1

Objective

To impart comprehensive knowledge about the production technology of medicinal and aromatic crops.

Theory

Herbal industry, WTO scenario, Export and import status, Indian system of medicine, Indigenous Traditional Knowledge, IPR issues, Classification of medicinal crops, Systems of cultivation, Organic production, Role of institutions and NGO's in production, GAP in medicinal crop production.

Production technology for Senna, Periwinkle, Coleus, Aswagandha, Glory lily, Sarpagandha, *Dioscorea* sp., *Aloe vera*, *Phyllanthus amarus, Andrographis paniculata.*Production technology for Medicinal solanum, Isabgol, Poppy, Safed musli, *Stevia rebaudiana, Mucuna pruriens, Ocimum sp.*

Post harvest handling – Drying, Processing, Grading, Packing and Storage, processing and value addition; GMP and Quality standards in herbal products. Influence of biotic and abiotic factors on the production of secondary metabolites, Regulations for herbal raw materials, Phytochemical extraction techniques.

Aromatic industry, WTO scenario, Export and import status, Indian perfumery industry, History, Advancements in perfume industry. Production technology for palmarosa, lemongrass, citronella, **v**ettiver, geranium, artemisia, mentha, ocimum, eucalyptus, rosemary, thyme, patchouli, lavender, marjoram, oreganum.

Post-harvest handling, Distillation methods, advanced methods, Solvent extraction process, steam distillation, Perfumes from non-traditional plants, Quality analysis, Value addition, Aroma chemicals, quality standards and regulations. Institutional support and international promotion of essential oil and perfumery products.

Practical

Botanical description, Propagation techniques, Maturity standards, Digital documentation, Extraction of secondary metabolites, Project preparation for commercially important medicinal crops, Visit to medicinal crop fields, Visit to herbal extraction units. Extraction of Essential oils, Project preparation for commercially important Aromatic crops, Visit to distillation and value addition units – Visit to CIMAP.

PSMA 506 BREEDING OF PLANTATION, SPICES, MEDICINAL AND AROMATIC CROPS 2+1

Objective

To impart comprehensive knowledge about the principles and practices of breeding of plantation crops and spices.

Theory

Species and cultivars, cytogenetics, survey, collection, conservation and evaluation, blossom biology, breeding objectives, approaches for crop improvement, introduction, selection, hybridization, mutation breeding, polyploid breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, molecular aided breeding and biotechnological approaches, marker-assisted selection, bioinformatics, IPR issues, achievements and future thrusts.

Crops

Coffee, Tea, Cashew, Cocoa, Rubber, Palmyrah, Oil palm, Coconut, Arecanut.

Black pepper, Cardamom, Ginger, Turmeric, Fenugreek, Coriander, Fennel, Celery, Ajwoain, Nutmeg, Cinnamon, Clove, Allspice.

Cassia angustifolia, *Catharanthus roseus*, *Gloriosa superba*, *Coleus forskohlii*, Stevia, *Withania somnifera*, *Papaver somniferum*, *Plantago ovata*, *Dioscorea* sp.

Chlorophytum sp, *Rauvolfia serpentina*, *Aloe vera*, *Ocimum* sp, *Phyllanthus amarus*, *Solanum* sp.Geranium, vettiver, Lemon grass, Palmarosa, citronella, Rosemary, Patchouli, Eucalyptus, Artemisia and Mint.

Practical

Characterization and evaluation of germplasm accessions, Blossom biology, studies on pollen behaviour, practices in hybridization, ploidy breeding, mutation breeding, evaluation of biometrical traits and quality traits, screening for biotic and abiotic stresses, haploid culture, protoplast culture and fusion- induction of somaclonal variation and screening the variants. Identification and familiarization of spices; floral biology anthesis; fruit set; selfing and crossing techniques; description of varieties. Salient features of improved varieties and cultivars from public and private sector, bioinformatics, visit to radiotracer laboratory, national institutes for plantation crops and plant genetic resource centers, genetic transformation in plantation crops for resistance to biotic stress/quality improvement etc.

PSMA507 PROCESSING OF PLANTATION CROPS 1 + 1

Theory:

Introduction, Principles and practices of post-harvest technology, commercial uses, Processing of major produce, value addition, grading and storage of plantation crops, viz. coconut, arecanut, cashewnut, oil palm, palmyrah, cocoa, tea, coffee, rubber, betel vine etc.

Practical:

Study of processing of different plantation crops and storage. Value added products from plantation crops.

PSMA 508 ORGANIC SPICE AND PLANTATION CROP PRODUCTION TECHNOLOGY 1+1

Objective

To educate principles, concepts and production of organic farming in spice and plantation crops.

Theory

Importance, principles, perspective, concept and component of organic production of spice and plantation crops.

Organic production of spice crops and plantation crops, *viz.* pepper, cardamom, turmeric, ginger, cumin, vanilla, coconut, coffea, cocoa, tea, arecanut.

Managing soil fertility, pests and diseases and weed problems in organic farming system; crop rotation in organic horticulture; processing and quality control for organic foods.

Methods for enhancing soil fertility, mulching, raising green manure crops. Indigenous methods of compost, Panchagavvya, Biodynamics, preparation etc.; Pest and disease management in organic farming; ITK's in organic farming. Role of botanicals and bio-control agents.

GAP and GMP- Certification of organic products; organic production and export - opportunity and challenges.

Practical

Method of preparation of compost, vermicomposting, biofertilizers, soil solarization, bio pesticides in horticulture, green manuring, mycorrhizae and organic crop production, waster management, organic soil amendment for root disease, weed management in organic horticulture. Visit to organic fields and marketing centers.

PSMA 509 UNDEREXPLOITED MEDICINAL AND AROMATIC CROPS 1+1

Objective

To facilitate understanding on the importance, conservation and cultivation of medicinal and aromatic crops.

Theory

Introduction, importance, present status and future prospects, origin, distribution, species, varieties, economic parts and their uses in different diseases, Biodiversity and conservation, RET (Rare, Endangered and Threatened) and MPCAs (Medicinal Plants Conservation Areas). Underutilized species – importance, traditional usage, ISM, TCM, Functional foods.

Production technology of underutilized medicinal crops– *Morinda citrifolia, Caesalpinia sappan, Caralluma, Terminalia chebula, Strychnos nuxvomica, Solanum trilobatum,* Physalis, *Aegle marmelos, Alpinia* sp., *Anthocephalus kadamba, Costus.*

Production technology of underutilized aromatic crops– *Curcuma aromatica, C. caesia, Coleus aromaticus, Ocimum kilimanjaricum, Bursera.*

National and international conservation network, IPR issues, Promotion of under utilized species, Processing and value addition, Marketing.

Practical

Case studies.

PSMA 510 PROCESSING OF SPICES, MEDICINAL AND AROMATIC PLANTS 1+1

Theory:

Commercial uses of spices and plantation crops. Processing of major spices - cardamom, black pepper, ginger, turmeric, chilli and paprika,vanilla, cinnamon, clove, nutmeg, allspice, coriander, fenugreek, curry leaf. Extraction of oleoresin and essential oils.

Processing of medicinal plants– dioscorea, gloriosa, stevia, coleus, ashwagandha, tulsi, isabgol, safed musli, senna, aloe, catharanthus, etc.

Different methods of drying and storage. Microbial contamination of stored product. Influence of temperature and time combination on active principles.

Extraction and analysis of active principles using TLC / HPLC / GC.

Distillation, solvent extraction from aromatic plants– davana, mint, rosemary, rose, citronella, lavender, jasmine, etc. Study of aroma compounds and value addition.

Nano-processing technology in medicinal and aromatic plants.

Practical:

Study of processing of different spices. Study of processing of medicinal plants, their drying and storage. Extraction of active ingredients from different spices and herbs using TLC, HPLC, GC/CG-MS technology. Distillation, solvent extraction from aromatic plants – davana, mint, rosemary, citronella, lavender, jasmine, etc.

Identification of differentodoriferous factors in essential oil with GLC/GC-MS. Physico-chemical and sensory evaluation of oils and oleoresin. Value added products from spices.