Department of Plantation, Spices, Medicinal & Aromatic Crop Sciences

M.Sc. Programme

Course No.	Title of the Courses	Credits
	1st Semester	
PSMA 501	Production Technology of Plantation Crops	2+1
PSMA 502	Production Technology of Spice Crops	2+1
PSMA 503	Production Technology of Medicinal and Aromatic Crops	2+1
	2nd Semester	
PSMA 551	Breeding of Plantation crops	2+1
PSMA 552	Breeding of Spices Crops	2+1
PSMA 553	Breeding of Medicinal and Aromatic Crops	2+1
PSMA 554	Production Technology of Organic Spice and Plantation Crops	2+1
	3rd Semester	
PSMA 601	Processing of Plantation crops, Spices, Medicinal and Aromatic Crops	3+1
PSMA 602	Underexploited Spice Crops	1+1
PSMA 649	Seminar I	1+0
	4th Semester	
PSMA 651	Underexploited Medicinal and Aromatic crops	1+1
PSMA 652	Production Technology of Organic Medicinal and Aromatic Crops	2+1
PSMA 699	Seminar II	1+0
PSMA700	Master Research	0+20

DEPARTMENT OF PLANTATION, SPICES, MEDICINAL & AROMATIC CROP SCIENCES

M.Sc. Programme

PSMA 501 Production Technology of plantation Crops (2+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, fertigation, moisture conservation, shade regulation, weed management, training and pruning, crop regulation, maturity indices, harvesting, post harvest management, plant protection measures, cost benefit analysis, management of drought and precision farming.

Crops

UNIT I: Coffee and tea
UNIT II: Cashew and cocoa
UNIT III: Rubber, palmyrah and oil palm
UNIT IV: Coconut and arecanut
UNIT V: 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 and visit to plantation areas.

PSMA 502 Production Technology of 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, quality control, pharmaceutical significance and protected cultivation of:

UNIT I
Black pepper and cardamom (small and large)
UNIT II
Clove, cinnamon, nutmeg and allspice
UNIT III
Turmeric, ginger and garlic
UNIT IV
Coriander, fenugreek, cumin, fennel, ajowain, dill, nigella and hints on cultivation of celery
UNIT V
Tamarind, garcinia and vanilla

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, basic post harvest technology and value addition and short term experiments on spice crops.

PSMA 503 Production Technology of Medicinal and aromatic crops (2+1)

Theory

UNIT I: Herbal industry, WTO scenario, export and import status, Indian system of medicine, Indigenous traditional knowledge, IPR issues, classification of medicinal crops, systems of cultivation, role of institutions and NGO's in production, GAP in medicinal crop production.

UNIT II: Production technology for Senna, periwinkle, aswagandha, sarpagandha, *Dioscorea* sp. (*D.deltoidea/ esculenta /prazeri /tomentosa*), *aloe vera*, *Phyllanthus amarus, Andrographis paniculata ,* hints on cultivation of glory lily and coleus .

UNIT III: Production technology for Medicinal solanum, Isabgol, poppy, safed musli, *Stevia rebaudiana, Mucuna pruriens* and *Ocimum sp.*

UNIT IV: Basic Post harvest handling and value addition.

Influence of biotic and abiotic factors on the production of secondary metabolites, Regulations for herbal raw materials and phytochemical extraction techniques.

UNIT V: Aromatic industry, WTO scenario, export and import status, Indian perfumery industry, history and advancements in perfume industry.

UNIT VI: Production technology for palmarosa, lemon grass, citronella, vettiver, geranium, artemisia, mentha

eucalyptus, rosemary, thyme, marjoram, oreganum, hints on cultivation of patchouli and lavender.

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 and herbal extraction unit. Extraction of essential oils, project preparation for commercially important aromatic crops, visit to distillation and value addition units – visit to CIMAP.

PSMA 551 Breeding of Plantation Crops (2+1)

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

UNIT I: Coffee and tea

UNIT II: Cashew and cocoa

UNIT III: Rubber, palmyrah and oil palm

UNIT IV: Coconut and arecanut

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 species , 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 and genetic transformation in plantation crops for resistance to biotic stress/quality improvement.

PSMA 552 Breeding of Spice Crops (2+1)

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

UNIT I: Black pepper and cardamom
UNIT II: Ginger and turmeric
UNIT III: Fenugreek, coriander, fennel and ajowain
UNIT IV: Nutmeg, cinnamon, clove and allspice

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 spice crops and plant genetic resource centers, genetic transformation in spice crops for resistance to biotic stress/quality improvement .

PSMA 553 Breeding of medicinal and aromatic Crops (2+1)

Theory

UNIT I:Plant bio-diversity, conservation of germplasm, IPR issues, major objectives of breeding of medicinal and aromatic crops, scope for introduction , cytogenetic background of important medicinal and aromatic crops, scope for improvement of medicinal and aromatic crops through selection, intra and interspecific hybridization, induced autotetraploidy, mutation breeding and biotechnological approaches.

UNIT II:Breeding for yield and quality improvement in medicinal plants, breeding for high herbage yield, essential oil and quality components, secondary metabolites in medicinal and aromatic crops, genetics of active principles and assay techniques useful in evaluation of breeder's material , breeding problems in seed and vegetatively propagated medicinal and aromatic crops.

UNIT III:Achievements and prospects in breeding of medicinal crops, viz. *Cassia angustifolia*, *Catharanthus roseus*, *Gloriosa superba*, *Coleus forskohlii*, Stevia, *Withania somnifera*, *Papaver somniferum*, *Plantago ovate* and *Dioscorea* sp.

UNIT IV:Prospects in breeding of medicinal crops, viz., *Chlorophytum* sp, *Rauvolfia serpentina*, *Aloe vera, Ocimum* sp*, Phyllanthus amarus* and *Solanum* sp.

UNIT V: Prospects in breeding of aromatic crops viz., Geranium, vettiver, lemon grass, palmarosa, citronella, rosemary, patchouli, eucalyptus, artemisia and mint.

Practical

Description of botanical features, cataloguing of cultivars, varieties and species in medicinal and aromatic crops, floral biology, selfing and crossing, evaluation of hybrid progenies, Induction of economic mutants, high alkaloid and high essential oil mutants, evolution of mutants through physical and chemical mutagens, Introduction of polyploidy, screening of plants for biotic and abiotic stress and environmental pollution, *in vitro* breeding in medicinal and aromatic crops.

PSMA 554 Production Technology of organic Spice and Plantation Crops (2+1)

Theory

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

UNIT II: Organic production of spice crops and plantation crops, viz. pepper, cardamom, turmeric, ginger, cumin, vanilla, coconut, coffee, cocoa, tea and arecanut.

UNIT III: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.

UNIT IV: Methods for enhancing soil fertility, mulching, raising green manure crops. Indigenous preparation methods of compost, panchagavvya, biodynamics etc., pest and disease management in organic farming , ITK's in organic farming. Role of botanicals and bio-control agents.

UNIT V: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, water management, organic soil amendment for root disease, weed management in organic horticulture. Visit to organic fields and marketing centers.

PSMA 601 Processing of Plantation Crops, Spices, medicinal and aromatic Crops (3+1)

Theory

UNIT I: Commercial uses of spices , plantation crops, medicinal and aromatic crops.

Different methods of drying and storage, microbial contamination of stored product, influence of temperature and time combination on active principles of spice crops, viz., cardamom , black pepper, ginger, turmeric, chilli and paprika, vanilla, cinnamon, clove, nutmeg , allspice, coriander, fenugreek and curry leaf. Extraction of oleoresin and essential oils.

UNIT II: Different methods of drying and storage, microbial contamination of stored product, influence of temperature and time combination on active principles of plantation crops, viz., coconut, arecanut, cashewnut, oil palm, palmyrah, cocoa, tea, coffee and rubber .

UNIT III:Different methods of drying and storage, microbial contamination of stored product, influence of temperature and time combination on active principles of medicinal crops, viz., dioscorea, gloriosa, stevia, coleus, ashwagandha, tulsi, isabgol, safed musli, senna, aloe and catharanthus.

UNIT IV:Extraction and analysis of active principles using TLC / HPLC / GC. Distillation, solvent extraction from aromatic plants– davana, mint, rosemary, rose, citronella, lavender and jasmine . Study of aroma compounds and value addition. Nano-processing technology in medicinal and aromatic crops.

Practical

Study of processing of different spices and plantation crops. Study of processing of medicinal crops, their drying and storage. Extraction of active ingredients from different spices and herbs using TLC, HPLC, GC/GC-MS technology. Distillation, solvent extraction from aromatic crops – davana, mint, rosemary, citronella, lavender and jasmine .
Identification of different odoriferous factors in essential oil with GLC/GCMS.
Physico-chemical and sensory evaluation of oils and oleoresin. Value added products from spices and plantation crops.

PSMA 602 Under exploited Spice Crops (1+1)

Theory
UNIT I:Anardana, angelica, aniseed ,asafoetida ,sage ,atis, vach and chandan
UNIT II:Basil, tejpat, chives, galangal ,savory,chamomile and isabgul
UNIT III:Horse Radish ,hyssop, lovage, mustard, shallot ,kesar and amla
UNIT IV: Parsely, poppy seed ,rosemary, saffron , star anise, haritaki and bahara
Practical
Morphological features, herbarium and digital documentation, centre of origin and distribution in India and the world. Case studies.

PSMA 651 Under exploited Medicinal and aromatic Crops (1+1)
Objective
Theory
UNIT I: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).
UNIT II:Underutilized species – importance, traditional usage, ISM, TCM and functional foods.
UNIT III:Production technology of underutilized medicinal crops– *Morinda citrifolia, Caesalpinia sappan*, *Caralluma, Terminalia chebula, Strychnos nuxvomica, Solanum trilobatum,* Physalis, *Aegle marmelos, Alpinia* sp., *Anthocephalus kadamba and Costus.*
UNIT IV:Production technology of underutilized aromatic crops– *Curcuma aromatica, C. caesia, Coleus aromaticus, Ocimum kilimanjaricum and Bursera.*
UNIT V:National and international conservation network, IPR issues, promotion of underutilized species, processing and value addition and marketing.
Practical
Morphological features, herbarium and digital documentation, centre of origin and distribution in India and the world, visit to CIMAP and case studies.

PSMA 652 Production Technology of Organic Medicinal and aromatic Crops (2+1)
Theory

UNIT-I:Importance, principles, perspective, concept and component of Organic production of medicinal and aromatic crops.

UNIT-II:Organic production of medicinal and aromatic crops viz., ,Senna, aswagandha, sarpagandha, periwinkle,arrowroot ,coleus, *Dioscorea* sp., vasaka, Aloe vera, *Andrographis panicalata, Morinda citrifolia,* cinchona plants, solanum, isabgol, safed musli, stevia, Ocimum sp., *Mucuna pruriens* ,kalmegh and bael

UNIT-III: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.

UNIT-IV: Methods for enhancing soil fertility, mulching, raising green manure crops, indigenous methods of compost, panchagavya, Biodynamics , preparation etc. , pest and disease management in organic farming , ITK'S in organic farming . Role of botanicals and bio – control agents.

UNIT-V:GAP and GMP – certification of organic products , organic production and export – opportunity and challenges.

Practical

Method of preparation of compost, vermicomposting, biofertilizers, soil solarisation, bio-pesticides in horticulture ,green manuring , mycorhizae and organic crop production. Water management, organic soil amendment for root disease, weed management in organic horticulture , visit to organic fields and marketing centers.