COURSE CAPSULES

First Semester

CS 5101. Principles of Crop Production (3)
Principles of field crop and horticultural crop production to include climate and ecology, seeds and sowing, measurement of crop growth, plant nutrition and fertilizers, weed control, irrigation, harvesting and storage.
Field visit: To an agricultural research station or a production farm.

CS 5102. Plant Water Relationships I (2)
Physiological and ecological importance of water in plant growth and agriculture, quantification of water availability in soil-plant-atmosphere system, principles and mechanisms of water transfer, factors determining water absorption by crop root systems, radial and axial translocation of water within plants, transpiration and water use efficiency.

CS 5103. Weed Biology (2)
Domestication of plants, agricultural and environmental weeds, survival mechanisms of weeds, weed-crop interactions, common weeds and their biology.
Practical: Identification of weeds and their propagules, field visits to identify the diversity of weeds in agricultural and natural ecosystems

CS 5104. Advanced Horticulture (2)
Introduction, scope of the horticulture sector, role of fruits and vegetables in food and nutrient security, recent advances and future trends in horticultural technology, environmental manipulation in horticultural crop production, principles and commercial application of photobiology/photomorphogenesis, advancements in perennial and herbaceous horticultural crop research, preharvest management, IPNS, IPM, value chain analysis, public sector inventions and incentives for the development of the horticulture sector, phytosanitory and other regulations.

CS 5105. Crop Physiology (3)
Framework for analysis of crop growth and yield formation, principles of radiation interception by crop canopies, radiation use efficiency, determination of crop development by temperature and photoperiod, photosynthesis and respiration at crop canopy level, biomass partitioning and determination of harvest index, physiology of crops, environmental stress conditions, water use efficiency, root and nutrient physiology, nutrient use efficiency.

CS 5106. Seed Physiology and Technology (2)
Importance and value of seeds in Sri Lanka, influence of environment on seed formation and development, seed viability and survival curves, seed dormancy, physiology of seed germination, seed vigour and vigour testing, seed production and post-harvest aspects of seeds, seed quality and seed testing, seed laws, seed certification, varietal characterizations.

legislative inactments in Sri Lanka pertaining to seed industry development. Business opportunities in the seed and planting materials industry.
Field visits: seed production farms and seed storage warehouses.

CS 5107. Protected Culture (2)
Introduction: designing and microenvironment control, soiless culture, hydroponics systems and plant nutrient management; sanitation and growing media use, supporting technologies, greenhouse crops and crop management, plant protection, use of micro-irrigation technologies, recent developments in research and technology, global review on high value crop industry, present status and improvement needs in the protected culture subsector of Sri Lanka.
Field visits: To production centres and materials.

CS 5108. Fruit Crop Management (2)
Natural history, evolution and domestication of fruit crops, the science of fruit production in tropical climates, present status and future potential of fruit industry in Sri Lanka, fruit crops grown in Sri Lanka and their ecological and climatic requirements, evolution, breeding history and physiology of high priority and other fruit crops, cultural practices that influence productivity, fruit quality and pest damage, marketing and economics, alternative production practices for commercial and home gardeners, related topics with respect to current literature, experimental techniques and applied technologies.

CS 5109. Olericulture (Vegetable Crop Production) (2)
Introduction, present status and improvement needs in Sri Lanka, cropping systems and crop management, sustainable vegetable production, vegetable crop improvement, value chain management, use of ICT for production planning, global review, advances in research and developments.
Field visits: Exposure visits on production and produce handling

CS 5110. Forest Ecology (2)
Ecosystem concepts, the physical and biotic environment, ecological energetics, transfer and storage of energy in ecosystems, ecosystem structure and species interactions, ecological succession, species strategies, pioneer and climax, productivity of forest ecosystems, nutrient cycling, major forest types, their climatic control and characteristics, role of forests, disturbance in ecosystems and regeneration of soil and vegetation, gap theory.
Field visits : To natural forests

CS 5111. Agroforestry (2)
Concepts and definitions, role of trees in agroforestry, systems of classification, advantages of agroforestry, ecological and socio-economic, structure, composition and functions of common agroforestry practices in Sri Lanka, species selection, tree-crop interface and ecological interactions in agroforestry, criteria used and evaluation of agroforestry, designing agroforestry practices, diagnosis and design (D&D).
Field visits : To different agroforestry systems

CS 5112. Plantation Forestry and Environment (2)
Impact of plantation forestry on environment, afforestration/reforestation objectives, choice of tree species, tree seed problems, nursery techniques, field planting, fertilizer application, weeding costs, silvicultural treatments, cleaning, pruning, thinning, timber stand improvement, regeneration techniques/silvicultural systems, high forest method and low forest method, growth and dynamics of stands, forest menseruation, age, diameter, height, stem form, bark thickness, tree crown, tree growth.
Field visits : To a well-managed forest plantation, measuring different stand parameters and evaluating the stand

CS 5113. Forest Influences on Soil, Water and Climate (2)
Introduction: Environmental problems in Sri Lanka, addressing environmental problems through forestry and related activities, current situation and future of the forestry sector; soil ecosystems; soil biodiversity, ecological significance of forest soils, sustainable soil management, hydrology of forest ecosystems, concepts of watershed management and current problems in watersheds, quantification of hydrological processes and soil erosion. climatic conditions and agro-ecological zones of Sri Lanka, global climate change, impacts of climate change on forest ecosystems, clean development mechanisms, forests as carbon sinks.

CS 5114. Biodiversity (2)
Introduction; levels, uses and threats, systematics, evolution and extinction, biodiversity in Sri Lanka, assessment, monitoring and interpretation of biodiversity information, biodiversity indices, biodiversity as an indicator, options for conservation: in situ, ex situ and circa situm, Agro-biodiversity in Sri Lanka, special topics related to biodiversity, red listing, biodiversity prospecting, benefit sharing, traditional knowledge, ecotourism, laws, treaties, agreements, conventions and international cooperation; use of biodiversity in developmental planning.

Practical: Investigation and quantification of biodiversity of different ecosystems and preparation of a biodiversity conservation plan for a selected area

CS 5115. Policy and Legislation Related to Forestry and Environment (1)
Introduction; Processes and products of policies, Evolution of forest, wildlife and environmental policies in Sri Lanka, policy formulation and stakeholder participation; policy objectives of forestry and environment, quantitative information for decision making, paradigms of forestry and agroforestry, sustainable, multiple use and multi resources management, institutional organization of forests, wildlife and environmental policies, politics and policies, gaps in existing policies, case study on policy development (group work).

CS 5116. Forest Systematics (2)
Principles and practices of plant systematics, nomenclature and identification of forest plants, patterns of variations of forest plants; experimental approaches to establish evolutionary relationships; value of systematics in conservation and management of forests.

CS 5117. Economics of Environmental Forestry (2)
Principles of market economic theory, investment appraisal in forestry, economics decisions related to rotation length, thinning and other operations, environmental valuation techniques in forestry, economic principles in natural resource allocation, economic perspective of sustainability.

CS 5118. Forest Products and Utilization (1)
Harvesting processes, systems and equipment, anatomical structure of wood, properties of wood, wood conversion, uses of wood, wood defects, seasoning and preservation of wood, wood products: composite products, pulp and paper; non-timber forest products: extraction, processing and utilization, environmental friendly forest production techniques.
Field visit : To timber processing centers

CS 5119. Landscape Horticulture (3)
Introduction to landscape Horticulture. History of landscaping. Materials used in landscape designs. Establishment and maintenance of soft landscape materials. Theories and principles of landscape garden designs. Application of garden design principles and techniques. Landscape gardening with emphasis on design construction. Planting designs, Principles and practices, Plant materials for landscape work, Relevant nursery stocks. Contract procedures, preparation of specifications, quantities, cost estimates, etc.
Practical: Identification of plants used in landscape designs. Introduction of design project, instructions, site investigation and evaluation.

CS 5120. Commercial Nursery Management (2)
Selection of nursery sites. Commercial nursery management. Nursery structures. Construction and maintenance of propagators according to climatic standards. Different types of nurseries. Nursery media. Compost preparation. Nursery bed preparation, shade, sterilization, cultural practices. Acclimatization and training, labor management, budget preparation and profit and loss management of a commercial nursery.

CS 5121. Landscape Architecture (2)
Principles and applications of landscape architectural design theories. Land development. Importance of regional landscape concepts. Ecological studies, landscape conservation. Studies on recreation potential. Application of design concepts to site planning. Landscape architectural site development concepts. Theories and techniques of site development, drainage principles and utilization of materials.
Practical: Development of a design for a proposed site.

CS 5122. Plant Growth Regulators (2)
Introduction, History and nature of endogenous growth regulators; Biosynthesis, Properties and modes of action. Physiological effects of growth regulators. Plant growth retardants. Targets for manipulation of crop growth and application of plant growth regulators.

CS 5123. Plant Tissue Culture - Micropropagation (2)

Introduction and history of plant tissue culture. Requirements to establish a commercial and a domestic laboratory. Laboratory cleanliness and maintenance. Tissue culture media, explant materials, aseptic procedures, and pathways of regeneration and tissue culture systems. Stages of micropropagation. Programmed production. Cost calculation of micropropagated plants. Low cost techniques in micropropagation, micropropagation of economically important plant species.

Practicals: Introduction and demonstration of laboratory equipment; chemical calculations and stock solution making, preparation of media for explant establishment, preparation of explant materials and in vitro establishment (Stage I); Transfer of cultures for Stage II and III. Acclimatization of tissue cultured plants. Establishment of explants and transfer of *in vitro* cultures of economically important species using CSUP low cost technique .

CS 5124. Field Crops in the Tropics (2)

Overview of tropical field crops and their present status with respect to food security; Climatic requirements of field crops; Management and yield improvement of tropical field crops with emphasis on crop physiology using one specific crop in cereals, legumes, root and tuber crops, sugar crops, fibre crops, spices, and narcotics; constraints to increasing production of tropical field crops, post-harvest technologies, issues of concern to students in tropical field crops.

CS 5125. Tropical Cropping Ecosystems (2)

Ecosystems in the tropics, crop communities, ecological resiliency, biomass accumulation, ecological systems, structure and functioning of crop ecosystems, niches and interactions, ecological features of tropical cropping systems, crop responses to limiting factors, crop-weed interactions and population dynamics in crops and weeds in the tropics, vegetation analysis, ecological basis of sustainable cropping, current developments in crop-ecosystem research.

CS 5126. Tropical Environments and Farming Systems (2)

Introduction to tropical environments: climate, edaphic, biotic; common landuse systems: lowland and upland annual/perennial cropping, traditional farming systems: shifting cultivation, dryland farming, ecological agriculture, organic farming; cropping systems and patterns; crop-livestock integration, evaluation of farming systems; Agroforestry and exploitation of agroforestry in the tropics, role of different farming systems in sustainable management of natural resources, understanding, sustaining and using tropical environments for food production.

CS 5127. Tropical Plant Diversity and Ethno-Botany (2)

Introduction; Tropical plant biology, taxonomy, identification and classification; Issues in tropical plant diversity: biodiversity, endemism, hotspots, diverse plant characters, measurements of diversity, mega diversity countries, tropical wilderness areas, eco-regions; Major monocot and dicot plant families; Plant diversity and development of tropical agriculture: past, present and future; Centers of plant origin and cultivation; Domestication; Introduction to ethnobotany; Methods in ethnobotanical studies; Phytochemistry and agriculture; Medicinal plants and tropical agriculture; Ethnobotany and future of tropical agriculture; Economic botany; Practical assignment on plant ingredients with respect to their botanical identification, classification, origin of cultivation and customary mode of preparation

CS 5128. Integrated Crop-Livestock Systems in the Tropics (2) (pass/fail course)

This practical program is designed to provide the students with a sound knowledge and understanding of scientific, technological, managerial, economic and sociological principles associated with crop-livestock integration, and post-harvest/product technologies in tropical environments.

CS 5129- Production Horticulture (3)

Crop requirements and regions of production, selection of cultivars, propagation and nursery management, field planting and crop management of major vegetable, fruit and floricultural species.
Practicals: Seed treatment, vegetative propagation, nursery management, training perennial crops, supporting annual crops, pest and disease prevention, harvesting indices and safety and work ethics.

CS 5130 - Cultivation and Processing of Plantation Crops (3)
Importance and scope of plantation crops in the Sri Lankan economy; Estate and smallholding sectors; Institutional support for growing plantation crops. Introduction to plantation crops: Botany, origin, uses, varieties, tea, rubber, coconut, export agricultural crops, oil palm, cashew; Cultivation practices, Climate and soil, propagation, planting, nutrition, irrigation, plant protection, harvesting, tea, rubber, coconut, export agricultural crops, oil palm, cashew, processing, quality and marketing, tea, rubber, coconut, export agricultural crops, oil palm, cashew.

CS 5131 - Tropical Field Crop Production (3)
History, usage and botany of tropical field crops (Rice, highland cereals, Grain legumes, Oil crops, Root and tuber crops, Sugar crops, Fiber crops, Spices and Narcotics). Climatic adaptations, Production technologies, Post-harvest handling and marketing, Issues related to food security, sustainability and climate change in tropical field crop production, Constraints to field crop production, Future developments.
***Field visits*:** Field Crop Research Institute, Mahailluppallama, Rice Research and Development Institute, Batalagoda. Visits to farmer fields

CS 5132-Sustainable Garden Management (2 units)
Concepts and determining factors, eco-farming of fruits and vegetables, plant identification and value of native plants, optimum use of natural resources in garden environments, availability of organic inputs, soil and water conservation, minimizing energy needs, design criteria, eco-friendly greenhouse technologies, evaluation of garden models for sustainability.

CS 5133 Plant Nutrient Management in Horticultural Crops (2)
Importance of plant nutrition for increasing productivity and produce quality of Horticultural crops, crop nutritional physiology, nutrient functions and the effects of fertilization and fertility management to achieve high yields and quality of specific Horticultural crops, crop adaptations and ways and means to improve nutrient use efficiency under optimum and stressed conditions specific to Horticultural crops, use of good agricultural practices (GAPs) to improve the quality and productivity of specific Horticultural crops, diagnosis of nutrient deficiency symptoms in specific Horticultural crops

CS 5134 Propagation Techniques for Horticultural Crops (2)
Introduction to cellular basis for sexual and asexual propagation, Methods of plant propagation, seed / vegetative propagation; Principles and practices of vegetative propagation techniques – cuttings, grafting and budding and layering; Current trends in propagation of Horticultural Crops; Litreature survey, and presenatation of findings

CS 5135 Horticulture in Temperate Regions (2)
Distinguish horticulture and related sub-sectors in temperate regions, relate characteristics to ecological, agricultural and social and economical identities of the region, minor deviations of horticulture based on regions and cultures, evaluation of selected horticultural systems, analysis of the horticultural trends in growing economies in the tropics.

CS 5136 -Value addition for Horticultural Produce (1)
Value added fruits and vegetables, principles and technologies of processing: canning, dehydration, extrusion and freezing; raw material quality; nutritional losses during processing; unit operations; case studies for assessing development needs of processing units.

CS 5137- Agronomy of Plantation Crops (2)

Status of the plantation crop sector, Land suitability classification, Land selection, sustainable land and soil management, and land preparation for plantation crops, agronomic practices used in plantation crops, effective and efficient resource utilization and productivity improvements, Harvesting practices and management aspects, product technology and machinery used in processing, Product value addition, by-products and new products.

CS 5138 Plantation Crop and Forestry Sector Policy and Legislation (1)

Profiles of Plantation crop and forestry sectors, economic and social benefits of plantation forestry, local and international scenario, critical issues in the sector: Issues, challenges, opportunities and strategies in the plantation and forestry industry, Organizational aspects of the sectors: ministries, state-owned and private sector organizations, trade unions; Policies and subsidy schemes relevant to the two sectors, Global and regional trade agreements, Social aspects related to workers and management; Estate and smallholder sectors; Record keeping; Possible improvements to face future challenges

CS 5139- Climate Change Adaptation, **Mitigation and Carbon Trading** (**1)**

Introduction to Global Climate change (CC), Contributing sectors for CC, Green House Gas (GHG) emission from the agricultural sector (specifically from plantation crop and forestry sectors), Climate change trends in Sri Lanka and vulnerable regions and sectors; Climate change (including the influences of *El-Nino*, *La-Nina* and UV change) and its impacts on plantation crop and forestry sectors, adaptation measures, technology needs for adaptation, mitigation strategies and options, carbon foot prints and greener products, dendro-thermal power generation and energy saving for plantation crop processing, energy plantations, Kyoto and newly emerging mechanisms for carbon trading (Clean development mechanisms [CDM], and REDD.)

CS 5140 - Quality Assurance in Plantation Industries (1)

Standards: requirements; Standards for quality, food safety, traceability & sustainability; International market; organizations involved; Certification systems, CCP's, MRL's, Certification processes, Corporate Social Responsibility initiatives & value chain, organic production; Waste handling, by-products; Ergonomics.

CS 5141- Emerging Trends in the Plantation Industry (1)

Colloquium on current and important issues in the plantation sector. 15 topics will be selected based on current issues in the plantation sector covering following topics: Improved techniques on cultural practices, Maximum land utilization, GAP's, GMP's, Occupational safety & health; Ergonomics; Introduction of 'bio' & 'GAP' products; MRL's; enhanced energy efficiency, Modernization of processing; Waste & energy auditing; Pollution prevention; Value addition by product diversification, packaging & incorporation of quality control, Implementation of internationally & locally recognized standards & certification systems; Organic farming, Plantation crop produce as health & natural products; Blending/ branding/ garden/ land marks/ logos; EIA; Cut flower production/ floriculture/ fruit crop production in plantations; Ecotourism.

CS 5142- Industrial Training (2)

Practical, on-farm training in selected estates of plantation crops for two (02) weeks, on the management and manufacturing / processing of a crop/s based on the student's preference, report writing. (Limited number of places may be available for a training in a tea estate/ UPASI in South India. Selection is based on the performance in other courses).

CS 5143 -Disaster Risk Reduction through Ecological Approaches (1)

Weather related natural hazards including land degradation and landslides, disaster risk reduction measures, agro-ecology and plantation crop based risk reduction technologies, livelihood improvements as a measure of disaster risk reduction.

CS 5144- Integrated Plantation Crops- Other Crops-Animal-Fish Based Farming Systems (1)

Crop selection in relation to soil type, climatic conditions and socio-economic resources, evaluation of different plantation crop / tree-based farming systems, Kandyan home garden systems, potential of using agroforestry and intercropping approaches in plantation crop husbandry, land evaluation and diversification, integration with animals and fish, evaluation of productivity of farming systems.

Second Semester

CS 5201. Crop Ecology (2)
Introductory ecology, Individuals, Populations, Communities, Ecosystems, Ecological Resiliency, Biomass accumulation, Ecological systems, structure and functioning of ecosystems, Niches, Interactions, Ecosystems in the tropics with emphasis on Sri Lanka. Ecological features of tropical cropping systems, Crop responses to limiting factors, Crop-weed interactions, Population dynamics in crops and weeds, Vegetation analysis, Ecological basis of sustainable cropping. Current developments in Crop-Ecosystem research.

CS 5202. Weed Control (2)
Prevention, eradication and management of weeds, methods of weed control (practices, advantages and disadvantages), Weed control in crop production systems.
Practicals: Calibration of sprayers, field visits to identify impact of different weed control techniques in annual and perennial crop production systems

CS 5203. Climate Change and Crop Production (3)
Introduction to climate and its relationship to agricultural production. Effects of climatic parameters on crop production. Measurement of climate and weather, recording and mapping. Changes in climate and their causes: Rising concentrations of carbon dioxide and other greenhouse gases, Green house effect and global warming, Increased UV radiation, ozone concentrations and air pollutants, Rise in sea levels and ocean temperatures, Natural climatic variations. Impact of climate change on productivity of agricultural crops, forestry and other natural ecosystems. Prediction of climate change and its impact, Adaptation to climate change.
Field visit: The Department of Meteorology, Colombo

CS 5204. Crop Management Techniques (3)
Conventional agriculture vs. alternative agriculture, cropping patterns and cropping systems, Integrated Plant Nutrient Management Systems (IPNS), Integrated Weed Management (IWM) and Integrated Pest Management (IPM), Integrated farming systems (crop-animal integration).

CS 5206. Postharvest Physiology & Management of Horticultural Produce (2)
Post-harvest management and problems in developing countries, Channels of food losses, Influence of pre-harvest factors on storage, Physiology and biochemistry of fruits and vegetables after harvest, Major causes of losses, post harvest handling of cut flowers, Reduction of post-harvest losses.

CS 5207. Physiology of Cereal Production (2)
Environmental influence of growth and development of cereals, Morphology and physiology of cereals in vegetative and reproductive phases of growth, Physiology of grain production.

CS 5208. Organic Crop Production (2)
Introduction to organic crop production, scope for organic crop production in Sri Lanka, techniques of organic crop production, constraints to increasing organic crop production in Sri Lanka. Sustainable agriculture systems, principles of organic agriculture, distinction from other farming systems, constraints in conventional agriculture, basis of organic certification, organic crop production, crop protection, soil fertiity and plant nutrition management, biodynamic agriculture, organic livestock, diversified organic farming
Field visits: to organic farms.

CS 5209. Plant Water Relationships II (2)
Drought and its relevance to crop productivity in Sri Lanka, Quantification of drought, drought resistant cultivars, canopy stomatal conductance and crop productivity, environmental and plant control of stomatal

conductance of crop canopies and forests, theory of optimal stomatal functioning in crop canopies, non-stomatal sources of water loss, basic principles of modelling crop growth and yield formation in water-limited environments, modelling of stomatal behaviour in crop canopies.

CS 5211. Tree Crop Physiology (2)
Physiological basis of growth, development and productivity of perennials, physiology of yields of major plantation crops: tea, rubber, coconut, export agriculture crops and physiology of major plantation forest species. Response of tree crop yields to environmental stress and climate change (nutrient, water, light, CO_2, temperature, UV etc.). Yield improvement of tree crops.
Practical: Field visit to study yield improvement programs in major tree crops

CS 5212. Scientific Writing and Proposal Formulation (2)
Research Methodology, definition, types of research. Research classification, identification and preparation of research projects. Scientific methodologies, hypothesis. Review of past work. Need for good scientific writing, structure and layout of a scientific paper, Title, Introduction Materials and Methods, Results, Discussion, Preparation of Abstracts, Synopses, Summaries, Resumes, Bibliographical identification, Acknowledgements. Style of reporting, Construction of sentences, Use of words, Use of international standards, Quantity units and symbols, Symbols for physical quantities, Use of abbreviations. Presentation of illustrations, Criteria, type of illustrations, their merits and demerits. Review process, Responsibilities of authors, editors and printers. Proof correction, Use of symbols. Oral presentation, Communication aids and their correct use, Practical assignments.

CS 5213. Participatory Forest Management (2)
Rural environment: Functions of woody biomass, biophysical and socio-economic features. Human ecology: farmer attitudes on trees and environment, origin and definition of participatory forestry approaches. Typology of participation, experiences and potentials of Rural Development Forestry (RDF) in Sri Lanka. Tools for RDF, indigenous ecological knowledge, farmer experimentation, methods of rural appraisal and forest resources assessment. Major issues: land and tree tenure, gender roles, institutions. Classical and new forester.

CS 5214. Natural Forest Management (2)
Rationale behind natural forest management, role of managed forests in conservation. Ecosystem concept and ecological basis of management, forest zoning, logging and its impact on natural forests. Criteria and indicators for sustainable management, rehabilitation, reclamation and restoration of degraded forests. Natural forest silvicultural systems. Ecological implications of social, political and economic elements of management. Successful case studies.
Practical: Preparation of a management plan for a selected forest

CS 5215. Ecological Interactions of Trees and Crops (2)
Introduction to abiotic interactions. Principles of resource capture and utilization of light, water and nutrients, Root and canopy distribution of trees and crops and microclimatic modifications, quantification of tree crop interactions, introduction to biotic interactions. Symbiotic and non symbiotic interactions in annuals and perennials; Nitrogen fixation; Mycorrhizal relationships. Environmental factors affecting symbiotic relationships. Measurements of symbiotic relationships and advantages. Ecological significance of symbiotic relationships in forestry and agroforestry systems. Allelopathic effects of trees and crops.

CS 5216. Urban Forestry and Arboriculture (2)
Introduction to urban forestry; Composition, role and benefits. Management of urban forests; Introduction to arboriculture; Role and benefits of plants in the landscape; Selection of plants; Inspection of plants; Land preparation for planting, root balling techniques, fertilization, irrigation, pruning and thinning; Pest and disease control; Wounds, decay and wood treatments.
Practical: Evaluation of urban ecosystems of major cities

CS 5217. Forest Tree Improvement and Genetic Conservation (2)

Essentials of genetic conservation and improvement in forest trees, current problems of conservation and tree improvement, tree improvement philosophies, achieving genetic gain and maintaining diversity, natural variation as the basis for genetic improvement and conservation, quantitative aspects of forest tree improvement, a conceptual approach for tree improvement, breeding strategies as the framework for improvement and conservation, non industrial tree improvement, innovation in tree improvement, practical applications and case studies.
Practical: Field visit to conserved and improved forest stands to elaborate potential and strategies of conservation and improvement

CS 5218. Quantitative Techniques in Forestry (2)
Introduction; Sampling methods in Forestry, fixed-area plot sampling, variable-area plot sampling, angle-count sampling, cluster sampling, block sampling, systematic sampling. Other aspects of sampling: temporary and permanent sample units; Types of forest models; Stand density; Canopy cover; Site Index; Diameter distributions; Diameter-height relations; Predicting growth and yields; Predicting current and future yield; Model evaluation.
Practical: Practicing different sampling methods in natural and plantation forests

CS 5219. Advances in Agroforestry (1)
Research and developments during the past two decades: trends and lessons learnt; Confronting complexity and dealing with difference, characteristics of long-established agroforestry practices; Performance and adoption of packaged agroforestry technologies; Agroforestry design: FSR/E and knowledge-based systems approach; Ecological approaches: transformation and analogue; Permaculture; Local and scientific knowledge on selection, arrangement and management of components; Agroforestry practices and policy.

CS 5220. Forest Growth Modelling (2)
Introduction; data requirements & types of forest models, Stand Density and Structure: stand density, crown cover, basal area percentile, C66, BALMOD, basal area-diameter-index; Point density; Neighbour tree relations; Modelling Stand Structure: anamorphic, disjoint polymorphic & non-disjoint polymorphic height models; Basal area; Generalized & bivariate diameter-height relations; Estimating product yield: volume ratio methods, modelling stem profiles; Classification of yield prediction models; Explicit & implicit prediction of yield; individual tree growth models; Qualitative & quantitative model evaluations.

CS 5221. Forest Biometrics (2)
Role of statistics in forestry and agroforestry; Experimental designs in forestry and agroforestry; Determination of plot size, number of blocks and orientation; Non-orthogonal data analysis; Non statistical considerations in forestry and agroforestry; Conventional and non-conventional sampling techniques in forestry and agroforestry; Growth models in forestry.

CS 5222. Commercial Floriculture (3)
Introduction. Requirement for establishment of a floriculture commercial nursery. Propagating structures. Market demand; export regulations, Commercial cut flower production. Propagation, cultivation practices, postharvest handling, post-harvest treatments. Flower drying and floral arrangements. Flower colour and fragrance; hybridization techniques. Potted plant productions, cultural practices, propagation systems, characteristics of commercial plants. Cut foliage: varieties, demand, harvesting, postharvest handling, postharvest treatments, Bonsai Production.
Practical: Identification of cut flowers and potted plants, Pollination techniques; post-harvest treatments for cut flowers and foliage, flower arrangements. Propagation techniques, commercial nurseries: commercial practices of cut flowers and potted plants (1 visit)

CS 5223. Indoor Gardening for Interior Decorations (2)

Use of potted plants for interior decorations and its advantages, Interior environment and its effect on plants. Acclimatization of potted plants for interior environments. Principles of interior decoration with potted plants. Categories of interior arrangements. Application of plant requirements for their selection and maintenance in interior environments, Eco-friendly ornamental house plants. Interior decoration as an enterprise.

Practical: Identification of plants for interior utilization; Identification of new plant species; Applications of interior decorations; dish garden; bottle garden, totem pole, window boxes.

CS 5224. Landscape Designs (3)

Application of landscape theories. Design planning, urban, suburban and home garden designs. Recreation and park designs. Roadside development designs. Landscape evaluation, Site analysis, Visual Impact Assessment (VIA) of plants. Introduction to Landscape Impact Assessment (LIA) using Computer Aided Designing (CAD)

Practical: Designing a given Project using Auto CAD.

CS 5225. Advanced Plant Tissue Culture (2)

Principles of plant cell culture; Types of isolated cell systems, callus cultures, cell suspension cultures, isolated cell culture and cell plating, artificial seeds for mass propagation. Expression of organogenesis and embryogenesis. Crop improvement techniques; protoplast isolation and fusion. mutagenesis; *in vitro* fertilization; embryo rescue; gene transformation and transgenic plants; haploid production. Molecular marker systems to identify new mutants

Practical: Isolation of explants, establishment of callus cultures; subculture of callus and establishment of cell suspension cultures, establishment of anther cultures, isolation of protoplasts, protoplast fusion, ,*in vito* fertilization, embryo rescue. Molecular marker sytem demonstration

CS 5229. Plantation Agriculture in Tropics (2)

Introduction and overview to plantation agriculture and its contribution to national economies of the tropics, agro-climatological and ecological requirements, agronomy of tea, rubber, coconut, and export agricultural crops under tropical environments; harvesting processing and manufacture, economics and marketing of plantation agriculture, Challenges faced in managing plantations.

CS 5230. Tropical Horticulture (2)

Introduction, climatic conditions in tropical environments, horticultural crops in tropical climates, cultural requirements of fruits, vegetables and flowers, techniques of culture and management of horticultural crops, factors affecting the production of fruits and vegetables in the tropics in relation to food security, post harvest technologies, study and discussion of significant topics and problems.

CS 5231. Crop Simulation Modelling (2)

Introduction to simulation models, empirical and mechanistic models, quantification of essential crop physiological processes, leaf and canopy photosynthesis models, components of respiration estimation models, models of biomass partitioning, quantification of crop water relations, crop water uptake and evapotranspiration models, Quantification of plant nutrient demand and uptake, modelling nutrient movement in soil, root growth and nutrient uptake, Introduction to currently used crop simulation models.

CS 5232. Physiological basis of Horticultural Crop Production (2)

Growth physiology of herbaceous and woody horticultural species, physiological basis of yield and quality management of horticultural crops through crop husbandry, environmental influences on the physiology of crop growth and development; physiological basis of post-harvest management of ornamental species, determining physiological indices through phyto-monitoring

CS 5233. Bioactive Compounds of Fruits and Vegetables (1)

Definitions and properties bioactive compounds, criteria used for classification. Characterization, biosynthesis and functional properties, role in human nutrition and health, composition in edible horticultural products, optimization through crop management and post-control

Practical: Laboratory analysis, information collection, analysis and presentation; teamwork through group assignments

CS 5234. Directed Study in Horticulture (2 units)

The course is a combination of two components

Component 1: Course work on Problem identification, proposal preparation, literature survey, technical writing and evaluation of research proposals

Component 2: Conducting data collection, analysis and scientific reporting based on a fact finding survey, laboratory/ field research on a proposal approved by a panel of evaluators (from the teaching panel) and under the supervision of an academic supervisor appointed by the Board of Study

CS 5235. Entrepreneurship Development in horticulture (1)

Introduction; design principles of entrepreneurships; categories of horticultural enterprises, production, produce handling, service provisions; elements of success and failures, need identification and case studies in horticulture entrepreneurships.

CS 5236. Biotechnology of Horticultural Crops (2 units)

Biotechnology in the Horticulture Industry; Applications of different molecular biological tools including plant transformation, gene expression, transgenic, over expression, gene silencing and RNA in different aspects of horticulture industry. Role of biotechnology in changing the physiology and architecture of horticultural crops.

CS 5238. Yield Physiology of Plantation Crops (2)

Introduction to the physiology of dry-matter production, crop yield and yield components; Canopy characteristics and light environment, canopy productivity (photosynthetic efficiency), source sink balance, dry matter partitioning, Physiological basis of productivity of plantation crops (tea, rubber, coconut, sugarcane, and export agricultural crops. Impact of abiotic interactions on crop yield (limitation of achieving genetic potentials), stress coping mechanisms to abiotic stresses, yield improvement strategies and techniques.

CS 5239. Processing and Value Addition of Plantation Crop Products (2)

Manufacturing and processing of plantation crops, Biochemistry of manufacturing and processing, quality attributes, biochemical basis of quality, relation with primary and secondary metabolic products, quality variations with different weather patterns, management and manufacturing processes; adulterations, improvements in processing to meet competitiveness, Waste management, Sensory/organoleptic evaluation, Product differentiation, value addition, by-products, new products; Energy conservation strategies

CS 5240. Plantation Crop Improvement (-2)

Breeding cycle as a conceptual basis for identification of current and future breeding requirements of plantation crops; Major problems of breeding and production of quality planting material of plantation crops; Tea breeding, rubber breeding, coconut breeding, breeding of other plantation crops, innovations in breeding of plantation crops.

Practical*:* Demonstration of breeding practices of tea, rubber, coconut and other plantation crops; Assignment: Development of breeding program for a selected crop

CS 5298. Directed Study and Seminar (5)

This course is designed to allow students to undertake an independent investigation in a selected field with the approval of the Board of Study. Results of the study will be presented at the seminar