Course Content - Department of Plant Sciences

BT 1008	Plant Resources	BT 3170	Aspects of Environmental Science**
BT 1009	Genetics and Cell Biology Practical	BT 3172	Special Topics in Bioinformatics**
BT 1010	Variety of Plant and Microbial Life Practical	BT 3901	Fundamentals of Landscaping**
BT 1011	Genetics and Cell Biology	BT 3902	Landscaping Assignment**
BT 1012	Variety of Plant and Microbial Life	BT 3903	Pest and Plant Disease Management**
BT 1013	Plant Structure	BT 3904	Commercial Horticulture and Floriculture**
BT 1114	Flora of Sri Lanka**	BT 3905	Plant Propagation**
BT 2001	Biostatistics	BT 3906	Computer Applications in Landscape Design**
BT 2013	Plant Development	BT 3907	Amenity and Therapeutic Horticulture**
BT 2014	Principles of Microbiology	BT 4018	Soil Science
BT 2015	Introductory Molecular Biology and Recombinant DNA Technology	BT 4019	Statistical Methods in Bioinformatics **
BT 2016	Microbiology and Molecular Biology Practical	BT 4020	Agro-biotechnology
BT 2017	Plant Biochemistry and Physiology	BT 4021	Biotechnology Industry
BT 2018	Plant Biochemistry and Physiology Practical	BT 4022	ECOLOGY
BT 2019	Plant Responses to Environmental Changes	BT 4026	General Paper in Plant Biology
BT 2020	Smart Horticulture for the 21st Century	BT 4027	Research Project in Plant Sciences
BT 3001	Plant Pathology	BT 4028	Research Project in Biotechnology
BT 3002	Horticulture	BT 4030	Literature Review and Seminar I
BT 3003	Plant Molecular Biology	BT 4031	Assignment
BT 3006	Plant Tissue Culture Technology**	BT 4032	Seminar II and Viva-Voce
BT 3008	Intellectual Property Rights **	BT 4033	Research Project in Bioinformatics
BT 3009	Environmental and Biodiversity Related Legislation in Sri Lanka**	BT 4035	Vegetation Description and Analysis
BT 3053	Introduction to Bioinformatics	BT 4036	Applications in Geographic Information Systems (GIS)**
BT 3058	Bioprospecting	BT 4105	Advanced Plant Biochemistry and Physiology**
BT 3061	Taxonomic Field Survey	BT 4107	Trends in Plant Molecular Biology**
BT 3063	Techniques in Molecular Biology	BT 4125	Post-harvest Technology**
BT 3064	Experimental Plant Biotechnology	BT 4134	Biodiversity Conservation**
BT 3066	Plant Systematics	BT 4901	Landscape Maintenance and Management**
BT 3071	Experimental Design and Data Analysis	BT 4902	Industrial Training**
BT 3073	Methods in Plant Breeding**	BT 4903	Seminar and Report**
BT 3105	Applied Microbiology**	BT 4908	Soil Management**
BT 3167	Phylogenetic Analysis**		

Course Code and Title: BT 1008: Plant Resources

Credit Value: 1 C (15 L)

Rationale: This course provides an overview of the past, present and potential uses of plants. Particular emphasis is given to plants used directly, as in food, or indirectly, as products used by humans or those used to enhance the environment. Economically important plants are presented in a botanical, phytochemical and ethnological context.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- provide examples for plants utilized for specific uses
- discuss the economic importance of selected plant families
- describe processes used to obtain plant derived products
- appraise how plants have influenced evolution of Earth and human life
- describe the origin and role of plants important to man
- evaluate novel uses and future potential of plants

Course Content: Renewable and non-renewable resources. Traditional uses and potentials: sources of food (cereals, legumes, root and tuber crops, vegetable crops, fruits),drug discovery and medicinal plants, spices, vegetable oils, fibrecrops, wood and wood products, beverage crops, ornamental plants, latex and resin plants, essential oils and perfume industry. Plants as an alternative energy source. Environmental sensors. Phytoremediation. Sustainable utilization & conservation of plants.

Method/s of Evaluation: End of semester theory examination

Recommended Reading:

- Simpson B., Ogorzaly M. (2000). Economic Botany: Plants in our world. McGraw-Hill Education.

Course Code and Title: BT 1009: Genetics and Cell Biology Practicals

Credit Value: 1 C (30 P)

Rationale: This course consists of a series of laboratory exercises intended to familiarize students with some core concepts and techniques in genetics and cell biology, by hands on experience. It complements the lecture course BT 1011 (Genetics and Cell Biology). Students will acquire and enhance specific laboratory skills including microscopy, spectrophotometry, isolation and biochemical identification of major biomolecules and organelles. The practicals on Genetics are meant to enhance student skills on interpretation of data from classical Genetic experiments and obtain hands-on experience in basic chromosome cytology.

Pre-requisites: BT 1011

Intended Learning Outcomes: At the completion of the course the students will be able to;

- acquire, and apply some fundamental technical, and laboratory skills relevant for cell biology
- organize and record experimental data by keeping a laboratory notebook
- develop analytical skills including graphical representations of experimental results
- apply the scientific method, including hypothesis formulation, hypothesis testing and experimental design, data gathering and analysis, extracting conclusions from experimental results
- write scientifically through preparation of formal laboratory reports written in established and acceptable scientific format with references to the appropriate scientific literature
- analyze and interpret data from classical Genetic experiments
- apply basic probability theory to determine the outcome of genetic crosses
- demonstrate skills in preparation of a simple root tip squash for mitotic chromosome observation
- determine chromosomal abnormalities in human chromosome complements
- Analyze human pedigrees to determine mechanisms of inheritance of genetic traits

Course Content: The course consists of laboratory experiments relevant for the BT1011 (Genetics and Cell Biology) module. Genetics practicals: Predicting patterns of inheritance using experimental data and testing Mendelian ratios using chi square analysis, chromosome behavior in mitosis and meiosis, human karyotype analysis, pedigree analysis, linkage analysis and gene mapping; Cell Biology practicals: Permeability of cell membranes and movement of water across cell membranes, extraction and identification of chemical constituents of cells, cell fractionation – isolation and microscopic examination of chloroplasts and nuclei, and demonstration of biochemical activity of isolated chloroplasts *in-vitro,* using Hill reaction.

Method/s of Evaluation: End of semester practical examination and/or assignments.

Recommended Reading:

- Lodish, H. et al. 2016. Molecular Cell Biology (8th Edition). W. H. Freeman
- Alberts, B. *et al*. 2013. Essential Cell Biology (4th Edition). Garland Science
- Alberts, B. 2014. Molecular Biology of the Cell (6th Edition). Garland Science
- Wilson, J. and Hunt, T. 2014. Molecular Biology of the Cell 6E - The Problems Book (6th Edition). Garland Science

Course Code and Title: BT 1010: Variety of Plant and Microbial Life Practicals

Credit Value: 1 C (30 P)

Rationale: This practical course unit will provide in depth knowledge and hands on experience on identification of bacteria, fungi, cyanobacteria, algae and different groups of plants around us and their tremendous diversity. This basic knowledge is essential for many other fields in biology.

Pre-requisites: BT 1012

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate safe handling of microorganisms under laboratory settings
- use a range of microbiological techniques to observe the micro-morphological characteristics of bacteria and fungi.
- design an experiment for a given objective
- describe morphological features and ecological habitats of members of the Kingdom Plantae.
- Identify characteristic features and modifications of lower and higher plants and their evolutionary relationships.
- Employ the theoretical knowledge and use of taxonomic and botanical literature for identification of plants.
- Employ the practical skills and knowledge in field and study the diversity of angiosperms and macro fungi in a particular habitat.

Course Content: Consists of practicals of module BT 1012 (Variety of Plant and Microbial Life): Identify and study the diversity and ecology of bacteria including cyanobacteria, macro and micro fungi; Study the tremendous morphological diversity and habitat diversity of blue green algae and algae; First land plants – the bryophytes, early vascular plants; psilophytes, lycophytes, sphenophytes, advanced vascular plants; ferns, gymnosperms and angiosperms; Evolutionary trends in land plants; Diversity of the angiosperms and the identification of several dominant angiosperm plant families in Sri Lanka; Plant identification using botanical literature (keys, checklists, field guides) and the use of herbarium for plant identification.

Method/s of Evaluation: Practical examination at the end of the semester (70%) and continuous assessments and the field based assignment (30%).

Recommended Reading:

- The Cambridge Illustrated Glossary of Botanical Terms – Michael Hickey (2000)
- Plant Identification Terminology: An Illustrated Glossary – James G. Harris (2001)
- Plant Systematics: A Phylogenetic Approach, 4th Edition (2015) – W. S. Judd, C. S. Campbell, E. A. Kellogg and P. F. Stevens; Plant Systematics (2006) – Michael G. Simpson

- Microbiology- A Laboratory Manuel (6th Edition) G. Cappuccino and N. Sherman

Course Code and Title: BT 1011: Genetics and Cell Biology

Credit Value: 2 C (30 L)

Genetics Component (15 L)

Rationale: The course intends to provide a thorough understanding of the fundamental basis of heredity in living organisms in order to prepare the students for more advanced study in Genetics, Genomics and Molecular Biology. It includes a detailed study of classical transmission of genetic information and provides an introduction to principles of genetics.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course students should be able to;

- explain how chromosomes are inherited through mitosis and meiosis and how genetic variation is generated
- analyze situations where Mendel's ratios will not be obtained
- analysetest-cross data and construct simple linkage maps
- discuss variations in chromosome structure and number and their consequences to plants and animals (including humans)
- discuss the consequences on structural aberrations in chromosomes and impact on life

Course Content: Overview of Mendelian genetics: Chromosomes and heredity: Cell cycle, mitosis, meiosis; Deviation from Mendelian patterns of inheritance; Spectrum of dominance, multiple alleles, pleiotropy, penetrance and expressivity, gene interactions, polygenic inheritance; Sex determination and sex linkage, aneuploidy of the sex chromosomes, X inactivation and dosage compensation in mammals, sex-limited and sex-influenced inheritance; Linkage and chromosome mapping: Incomplete linkage, crossing over and chromosome mapping, somatic cell hybridization and human gene mapping, haploid organisms in mapping studies, ordered and unordered tetrad analysis; Chromosome number variation, aneuploidy and polyploidy; Variation in chromosome structure and arrangement: Deletions, duplications, inversions and translocations, fragile sites in humans; Gene mutations: Types of gene mutations, somatic vs. germline mutations, transposable elements and mutagenesis; Applications of Genetics in Biotechnology

Method/s of Evaluation: End of semester exam

Recommended Reading:

- Genetics – From genes to genomes (Hartwell et al.,2000)
- An Introduction to Genetic Analysis (Griffiths, A. J., Miller, J.H., Suzuki, D.T., Lawontin, R.C. and Gilbert, W.M.) 1996, 6th ed.
- Concepts of Genetics (Klug, W.S. and Cummings, M.R.) 1986
- Principles of Genetics (Gardner, E.J. and Snustad, D.P.) 1994

- Genetics (Weaver, R.F. and Hedrick, P.W.) 1997

Cell Biology Component (15 L)

Rationale: This course is designed to introduce basic principles of cell biology while specifically examining life processes at the cellular level. Cell chemistry and relationship between cell structure and function will be discussed with special emphasis on membranes. Mechanisms of transport across cell membranes will be taught while discussing examples with relevance to human health. Cellular communication/ signal transduction will be introduced as the vital process in generating cellular responses to internal or external signals.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course students should be able to;

- list/ explain the fundamental features of prokaryotic and eukaryotic cells
- describe the structure, composition and role of eukaryotic cell membranes
- recognize and list roles for the major cell organelles
- name/explain specific processes and proteins involved in membrane transport
- define signal transduction and give examples of intercellular chemical messengers.
- describe receptor subclasses and their possible uses in cell signaling.

Course Content: Introduction to cell biology: Biology of cells of higher organisms; Structural organization of bio-membrane: Lipids- classes of membrane lipids, hydrophobic interactions, universality of the lipid bilayer, proteins- types of membrane proteins, integral proteins, trans-membrane proteins, peripheral proteins, carbohydrates- glycolipids, glycoproteins; Fluid mosaic model of bio membranes; Transport across cell membranes: Principles of membrane transport, diffusion, passive diffusion, facilitated diffusion, active transport, carrier and channel proteins, transporters, uni-porters, co-transporters, primary and secondary active transport, symporter, anti-porter, transport systems functioning in animal and plant cells; Cell to cell signaling: Membrane receptors and signaling, cell surface receptors and signal transduction, G-protein linked, enzyme linked, ion channel linked receptors, second messengers, cAMP, Ca^{++} signaling pathways, examples of cell surface receptors in heart muscles, insulin receptors.

Method/s of Evaluation: End of semester theory examination; Assignments

Recommended Reading:

- Lodish, H. et al. 2016. Molecular Cell Biology (8th Edition). W. H. Freeman
- Alberts, B. *et al*. 2013. Essential Cell Biology (4th Edition). Garland Science
- Alberts, B. 2014. Molecular Biology of the Cell (6th Edition). Garland Science
- Wilson, J. and Hunt, T. 2014. Molecular Biology of the Cell 6E - The Problems Book (6th Edition). Garland Science

Course Code and Title: BT 1012: Variety of Plant and Microbial Life

Credit Value: 2 C (30 L)

Variety of Plant Life Component (15 L)

Rationale: 'Variety of Plant life' introduces the lineages of plants that evolved through millions of years. The evolution and diversification of land plants have shaped life on Earth. General understanding of different groups of plants that we see today, and those existed in the past will be provided as a foundation for other plant based studies.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- appreciate the diversity of the plant world, and identify different plant groups and their characteristic features.
- identify the morphological, ecological, and reproductive diversity of the members of these plant groups.
- review the evolutionary affinities and trends among the different plant groups.

Course Content: Evolution of life on earth: environmental changes and basic requirements; Cyanobacteria and algae: morphological diversity, basic characteristics, ecology, evolution of eukaryotes and evolutionary trends; Origin of land plants: bryophyte morphology, different groups of bryophytes, reproductive strategies; Life on land: challenges of a terrestrial environment, adaptation to life on land; Evolution of seedless vascular plants: evolution of vascular tissues, heterospory, Psilophytes, Lycophytes, Sphenophytes, Pteridophytes, morphological diversity of ferns and their ecology; Evolution of seed plants: evolution of seed and its advantages, morphological diversity of gymnosperms (Coniferophyta, Cycadophyta, Ginkophyta and Gnetophyta); Diversity of angiosperms: major lineages of angiosperms, morphological variations, major angiosperm plant orders and families.

Method/s of Evaluation: End semester theory examination.

Recommended Reading:

- Plant Evolution: An Introduction to the History of Life (Karl J. Niklas) 2016
- Campbell Biology (Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky) 2016, 11thEdition

Microbial Life Component (15 L)

Rationale: This course is aimed at developing an understanding of appropriate and relevant fundamental and applied scientific knowledge on microorganisms. It provides an overall idea of what microorganisms are, their place in biosphere, basic structures, growth requirements and useful applications.

Pre-requisites: None

Intended Learning Outcomes: At the end of the course the students will be able to;

- describe the characteristics of different classes of microorganisms.
- identify ecological and physiological groups
- explain the factors affecting microbial growth
- describe a range of microbiological applications in industry, medicine, pharmacy, etc.

Course Content: The origin of life; Major groups of microorganisms and their evolutionary relationships; Bacteria: morphology and structure, metabolism and reproduction, Economic Importance; Fungi: Diversity and classification, major characters, morphology and structure, ecology &nutrition, characters and types of spores, hyphal modifications, hyphal aggregations, reproduction, characters of major groups, habitats, fungal associations, economic Importance; Introduction to Mycoplasma, Archaea, Viruses and sub-viral agents.

Method/s of Evaluation: End of semester theory examination

Recommended Reading:

- Introductory Microbiology, Heritage, J et al., 1996 (Cambridge low price editions);
- Microbiology- An Introduction (5th Edition) G. J. Tortora, B. R. Funke, C. L. Case (1994)
- Brock Biology of Microorganisms (14th Edition, 2014). M.T. Madigan, J.M. Martinko, K.S. Bender, D. H. Buckley, D. A. Stahl, T. Brock
- Fungal Biology. Harry J. Hudson (1986)

Course Code and Title: BT 1013: Plant Structure

Credit Value: 1 C (5 L, 20 P)

Rationale: The functions of plants are tied up with organization of the plant body. It is aimed at giving a comprehensive insight to the plant body and the variations of structure according to the function/s they perform.

Pre-requisites: None

Intended Learning Outcomes: At the end of the course the students will be able to;

- identify the main cell types and tissues of the plant body
- describe the tissues/tissue systems and their functions
- correlate variations in structure to the function
- identify structural adaptations to environmental conditions
- develop skills in taking sections of plant body and observing the structures

Course Content: Cell wall structure; Types of tissues of plant body, tissue systems; Angiosperm shoot and root apex organization; Primary and secondary structure of the stem and root: dicot and monocot; Leaf structure: dicot and monocot; Ecological anatomy.

Method/s of Evaluation: End of semester examination and an assignment

Recommended Reading:

- Plant Anatomy, B.P. Pandey, 1996
- Plant Anatomy Part I: Cells and Tissues (Second Edition) Elizabeth G. Cutter, 1978
- Biology of Plants, Peter H. Raven, Ray F. Evert, Susan E. Eichhorn, 2005.

Course Code and Title: BT 1114: Flora of Sri Lanka**

Credit Value: 1 C (5 L 20 P)

Rationale: This course provides students the basic knowledge on heterogeneous landscapes of Sri Lanka, general vegetation types and distribution of native and exotic plants in these habitats in spatial and temporal scales.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- explain the landscape heterogeneity in Sri Lanka and its importance
- identify common but distinct visible characteristics of different landscapes, habitats and their major vegetation types
- name dominant plants of vegetation types found in coastal, inland and aquatic ecosystems
- relate occurrence, distribution and spread of plants with human induced land-use changes in Sri Lanka

Course Content: Affinities and components of Sri Lankan flora; Plant communities of terrestrial and aquatic natural ecosystems: forests, grasslands, savanna, thorn scrubs, sand dune vegetation, wetlands, mangroves, rivers and reservoirs, sea weeds and sea grass beds; Plants in urban areas and their importance; Plant groups of special ecological interest: alien invasive species, native and exotic ornamental species, threatened, and protected plants.

The practical component will be based on desk and field studies on above topics.

Method/s of Evaluation: End of semester examination (50%) and assignments (50%)

Recommended Reading: Literature provided by the lecturer

** Detail syllabi approved by the CDEC (in the form of new format)

Course Code and Title: BT 2001: Biostatistics

Credit Value: 2C (15L 30P)

Rationale: This course provides an overview of basic statistical principles used in the study of biology. Students are provided with a set of statistical tools that can be used in the analysis, description and presentation of experimental data.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- describe statistical principles
- apply suitable statistical principles
- calculate statistical significance
- design hypotheses to solve given problems

Course Content: Introduction to statistics and basic terms. Organization of data – frequency distributions. Description of data: graphical forms and numerical forms. Probability and probability distributions (discrete random variables and continuous random variables). Sampling distributions. The central limit theorem and sampling distributions for sample means. Introduction to statistical inferences: Estimation (point and interval estimates) and Hypothesis testing. Inferences involving one population (Inferences about population mean, inferences about population variance and standard deviation). Inferences involving two populations: Independent samples and Dependent samples (Paired samples).

Method/s of Evaluation: End of semester theory examination

Recommended Reading:

- Abebe, A. Daniels, J. McKean, J.W., Kapenga J.A. (2001). Statistics and Data analysis. Western Michigan University. E book

Course Code and Title: BT 2013: Plant Development

Credit Value: 1 C (15 L)

Rationale: This course provides a basic understanding on anatomical, physiological and molecular changes and processes associated with growth and development of flowering plants. The course focuses on mechanisms that control the different stages in the development process and further discusses how plants modulate their growth and development in response to the environment.

Pre-requisites: None

Intended Learning Outcomes: By the end of this course the students will be able to;

- demonstrate an understanding on anatomical and physiological events associated with vegetative & reproductive growth, and development of flowering plants.
- review how plants modulate their development in response to the environment (developmental plasticity)
- discuss applications of growth and development of plants in agriculture and horticulture.

Course Contents: Life cycle of a flowering plant; Phytochrome and light control of plant development, blue-light responses, photomorphogenesis; Reproductive development: Control of flowering, photoperiodism, vernalization, transition to flowering, fruit development; Seed formation, dormancy, germination, seedling development; Abscission and senescence.

Method/s of Evaluation: End of semester theory examination.

Recommended Reading:

- Suggested Reading: Plant Physiology (Taiz, L. and Zeiger, E.) 2002, Sinauer Associates Inc.
- Plant Physiology (Salisbury, F.B. and Ross, C.) 1991, 4th Rev Ed., Wadsworth Publishing Co. Inc.

Course Code and Title: BT 2014: Principles of Microbiology

Credit Value: 1C (15L)

Rationale: This course is aimed at developing an understanding of evolution of organisms from the basic microbial life forms. It further introduces students to fundamentals in microbial physiology and ecology. Kinetics of microbial growth, growth control and human-microbe interactions are also discussed.

Pre-requisites: BT 1012

Intended Learning Outcomes: At the end of the course the students will be able to;

- relate microbial physiology to their habitats
- describe growth characteristics of microorganisms
- demonstrate and explain the techniques used in microbial growth control and sterilization
- describe the human microbiome and the role of microbionts in maintaining human health
- describe the mechanisms of bacterial pathogenicity and the common bacterial diseases of humans

Course Content: Factors affecting the growth of microorganisms; Culturing microorganisms; batch and continuous cultures; Enumeration of microorganisms; Control of microorganisms: physical methods: heat, filtration and irradiation, chemical methods: antiseptics, disinfectants, detergents, sanitizers etc.; Antimicrobial drugs: types, modes of action, development of antibiotic resistance; Microbe-human interactions, human microbiome, mechanisms of microbial invasion and establishment, bacterial toxins, mechanisms of evasion of body defense; Introduction to important disease causing bacterial groups

Method/s of Evaluation: End of semester theory examination

Recommended Reading:

- Introductory Microbiology, Heritage, J et al., 1996 (Cambridge low price editions);
- Microbiology- An Introduction (5th Edition) G. J. Tortora, B. R. Funke, C. L. Case (1994)
- Brock Biology of Microorganisms (14th Edition, 2014).M.T. Madigan, J.M. Martinko, K.S. Bender, D. H. Buckley, D. A. Stahl, T. Brock
- **Fungal Biology. Harry J. Hudson (1986)**

Course Code and Title: BT 2015: Introductory Molecular Biology and Recombinant DNA Technology
Credit Value: 1C (15L)

Rationale: Molecular biology is the study of structure, function and interaction of biologically important molecules such as nucleic acids and proteins, and examination of biological systems at the molecular level. This course aims to introduce fundamental concepts in molecular biology and provide a foundation for advanced courses in cell and molecular biology and research.
Pre-requisites: BT 1011

Intended Learning Outcomes: At the end of this course the students will be able to;

- illustrate the gene structure and organization in both eukaryotes and prokaryotes
- explain the process of transcription, translation and the molecular mechanism of DNA replication and repair
- describe the structure of an operon and its regulation
- explain the concept of recombinant DNA technology and outline the steps involved in making a recombinant DNA molecule
- describe fundamental molecular biology techniques – PCR, gel electrophoresis, Sanger sequencing
- define terminologies such as genome (genomics), transcriptome (transcriptomics) and proteome (proteomics)
- recognize the importance of biosafety standards

Course Content: Gene structure and organization in both prokaryotes and eukaryotes; Transcription (from DNA to RNA) — different types of RNAs (mRNA, rRNA and tRNA), RNA Polymerases, transcription process, RNA splicing and nuclear export of RNA, regulation of transcription (*lac* operon); Translation (from RNA to protein) — genetic code, tRNA structure and function, codon and anticodon base pairing, ribosome structure, translation cycle: initiation, elongation and termination; Brief introduction to omics: genomics, transcripomics, proteomics; DNA replication and repair; Recombinant DNA technology and its application — molecular cloning, bioethics, PCR, Agarose gel electrophoresis, DNA sequencing (Sanger method, introduction to NGS), GM crops, biosafety.

Method/s of Evaluation: End of semester written examination

Recommended Reading:

- Lodish, H., Berk, A., Baltimore, D., Matsudaira, P., Zipursky, S. L. and Darnell, J. (2000). Molecular cell biology. New York: W. H. Freeman.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. (1989). Molecular biology of the cell. New York: Garland Publishing Inc.
- Lewin, B. (1990). Gene IV. USA: Oxford University Press
- Reviews and journal articles relevant to the subject

Course Code and Title: BT 2016: Microbiology and Molecular Biology Practicals

Credit Value: 1C (30 P)

Rationale: This course is aimed at developing essential technical skills - in Microbiology and molecular biology laboratory.

Pre-requisites: BT 1012

Intended Learning Outcomes: At the end of the course the student will be able to;

- demonstrate safe handling of microorganisms under laboratory settings
- apply a range of standard microbiological techniques
- develop skills needed to work in a commercial microbiological laboratory
- design experiments for a given objective
- illustrate the basic steps involved in nucleic acid extraction of a given organism
- explain the purpose, key components and steps involved in the polymerase chain reaction (PCR) process
- explain how gel electrophoresis works and its applications
- produce the amino acid sequence encoded by a given DNA sequence

Course Content: Preparation of culture media, sterilization techniques, isolation and enumeration methods, techniques used for observation and characterization of microorganisms, antibiotic susceptibility tests, extraction of nucleic acids from plant tissues, polymerase chain reaction, gel electrophoresis of nucleic acids, dry lab demonstration of Sanger sequencing, transcription, translation and cloning

Method/s of Evaluation: End of semester practical examination (100%)

Course Code and Title: BT 2017: Plant Biochemistry and Physiology

Credit Value: 2 C (30 L)

Rationale: This course aims to introduce major important aspects of plant metabolism and their role in the functioning of the whole plant. Pathways of central metabolism will be taught with emphasis on features unique to plants. Significance of hormonal regulation of plant growth and development will be discussed. Emerging applications such as bioenergy production, phytoremediation, genetic modifications for desirable traits etc. will be discussed under relevant topics. Development of an understanding of the physiology of plants will support the students in contributing to ongoing debates about overcoming the impacts of climate change, global food insecurity, rise of water scarcity etc.

Pre-requisites: BT1011

Intended Learning Outcomes: At the completion of the course the students will be able to;

- demonstrate knowledge and understanding of the aspects of plant biochemistry and physiology covered in the course
- distinguish and evaluate the different plant strategies for capturing light and the processes governing carbon capture by leaves
- evaluate the various types of plant adaptations to maximize the efficacy of carbon fixing under different environments and climatic conditions
- apply concepts of plant biochemistry and physiology to discussions about global climate change, crop productivity, water scarcity, carbon and water trade-offs etc.

Course Content: Metabolism; Thermodynamics and bioenergetics; Enzymes: Structure, Properties, Activation energy, Mechanisms of action, Factors affecting rates of enzymatic reactions, Inhibition of enzyme activity, Co-factors, Isozymes and metabolic significance, Enzymes in industry; Photosynthesis: Historical summary, Chloroplast structure and pigments, Light absorption and transfer, Thylakoid membrane and major photosynthetic complexes, Thylakoid electron transport chain and photophosphorylation, Photosynthesis and herbicides, Carbon fixation: Calvin cycle (C3 photosynthesis) and its regulation, Photorespiration and C2 oxidative photosynthetic carbon cycle, Consequences for photosynthetic efficiency, Evolution of alternatives to C3 photosynthesis- C4 pathway, Crassulacean Acid Metabolism (CAM), Environmental and agricultural aspects; Synthesis of sucrose and starch; Plant respiration: Glycolysis, Fermentation, Citric acid cycle, Mitochondrial electron transport chain, Proton gradient and oxidative phosphorylation with emphasis on plant specific features, Pentose Phosphate Pathway, Carbon flux and the significance of respiratory metabolism; Mineral nutrition: Essential mineral elements and criteria for essentiality, Beneficial elements, plant analysis for mineral content, basic techniques of growing plants for mineral nutrition studies, Hydroponics and applications, Nutrient disorders, Fertilizers and their application; Plant hormones/growth regulators: Chemistry, physiology, biosynthesis, transport, regulatory processes and mechanisms of action of auxins, cytokinins, gibberellins, abscisic acid, ethylene, Brassinosteroids and jasmonates as plant growth regulators, Commercial applications of plant

growth regulators*;* Transport and translocation of water and solutes: Water potential concept, water transport mechanisms; Movement of photosynthate/phloem translocation: Mechanisms of translocation;Brief introduction to plants' responses to biotic and abiotic stresses.

Method/s of Evaluation: End of semester theory (written) examination; Assignments

Recommended Reading:

- Taiz, L., Zeiger, E., Møller, I. M. and Murphy, A. **2014. Plant Physiology and Development** (6th Edition). Sinauer Associates, inc.Or
  Taiz, L. and Zeiger, E. 2010. **Plant Physiology (5th Edition)** Sinauer Associates, Inc.
- Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V. and Reece, J.B. 2016. **Campbell Biology (11th Edition)**. Pearson.
- Berg, J. M., GattoJr.**,G. J., Tymoczko, J. L. and Stryer, L. Biochemistry** (8th Edition). 2015. W. H. Freeman

Course Code and Title: BT 2018: Plant Biochemistry and Physiology Practicals

Credit Value: 1 C (30 P)

Rationale: This course consists of a series of laboratory exercises intended to familiarize students with some core concepts and techniques in plant biochemistry and physiology, by hands on experience. It complements the lecture course BT2017. The course will also provide the students with opportunities to explore the application of the scientific method.

Pre-requisites: BT 2017

Intended Learning Outcomes: At the completion of the course the students will be able to;

- acquire, develop, employ and integrate a range of technical, and laboratory skills relevant for plant biochemistry and physiology
- organize and record experimental data by keeping a laboratory notebook
- develop data analysis, statistical, and analytical skills including the use of MS Excel and graphical representations of experimental results
- apply the scientific method, including hypothesis formulation, hypothesis testing and experimental design, data gathering and analysis, extracting conclusions from experimental results
- write scientifically through preparation of formal laboratory reports written in established and acceptable scientific format with references to the appropriate scientific literature
- develop critical thinking and scientific reasoning skills through assessment of experiments and scientific papers

Course Content: This course consists of laboratory sessions relevant for topics covered under the BT 2017 Plant Biochemistry and Physiology module. Experiments will be conducted on nature of enzymes and enzymatic reactions, respiration, photosynthesis, plant mineral nutrition, plant growth Regulators and water relations of cells.

Method/s of Evaluation: End of semester practical examination and/or assignments.

Recommended Reading:

- Taiz, L., Zeiger, E., Møller, I. M. and Murphy, A. **2014. Plant Physiology and Development** (6th Edition). Sinauer Associates, inc.Or
  Taiz, L. and Zeiger, E. 2010. **Plant Physiology (5th Edition)** Sinauer Associates, Inc.
- Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V. and Reece, J.B. 2016. **Campbell Biology (11th Edition)**. Pearson.
- Berg, J. M., GattoJr.**,G. J., Tymoczko, J. L. and Stryer, L. Biochemistry** (8th Edition). 2015. W. H. Freeman

Course code and Title: BT 2020: Smart Horticulture for the 21st Century (Level II – elective)

Credit value: 1 credit (5L, 20 P)

Rationale:

This course is designed for the post-millennial students, with the intention of providing them with knowledge and hands-on experience related to practical and modern horticultural techniques. The course will emphasize on making use of the digital/e/smart tools and apps to overcome the challenges faced during growth and maintenance of crops and ornamentals in this modern era.

Pre requisites: None

Intended Learning Outcomes: After completion of this course, students will be able to:

- recognize the importance of learning novel horticultural techniques in crop and ornamental cultivation as a post-millennial
- demonstrate competence in using horticultural techniques
- identify and utilize appropriate smart/e/digital agricultural tools/ apps and techniques when and where necessary

Course content:

Meet the trendsetters: Discussions with Horticulturists/Agriculturists; Cultivating your own food crops: Basics of cultivation and maintenance of selected food crops, Introduction to vegetative propagation; Introduction to smart/e/digital Agriculture: Introduction to Precision agriculture, Smart farming technologies, Smart villages with self-sufficiency in food, Use of mobile/computer apps/drone technology for growing crops and market predictions; Vertical and Soil-less gardening: Basics, techniques and smart tools used in vertical gardening and Hydroponic cultivation; Landscaped backyard & Ornamental plant cultivation: Introduction to basic landscaping techniques, Cultivation of orchids and roses, Pesticide free crops: Basics of pests, insects, nature-healthy plants, natural solutions for pests and the use of smart tools in eliminating pests; Growing your vegetables from kitchen waste: Hands on experience on growing selected crops from kitchen waste and learning the sciences behind; Mini greenhouse in a balcony: Basic requirements of a greenhouse, Converting the balcony into a mini greenhouse.

Method/s of Evaluation: In-class Assessments: 50%, End of semester practical examination: 50%

Recommended Reading:

- Janick, J. 1986. Horticultural Science. W.H Freeman (4th ed.)
- Acquaah, G. 2008. Horticulture: Principles and Practices. Pearson (4th ed.)
- Rahman, R. and Fong, J. (2016). Innovate for agriculture: Young ICT entrepreneurs overcoming challenges and transforming agriculture. Technical Centre for Agricultural and Rural Cooperation. The Netherlands

Course Code and Title: BT 2019: Plant Responses to Environmental Changes

Credit Value: 1C (5L, 20P)

Rationale: This course provides hands on experience in practical aspects of the basic plant science courses conducted in Level I and Level II. The students are expected to conduct a group project related to plant responses to environmental changes and get both field and laboratory experience. This module is specifically designed to provide real life experience to enhance the knowledge gained through plant science courses.

Pre-requisites: None.

Intended Learning Outcomes: At the completion of the course the students will be able to;

- identify and formulate basic research problems related to plant sciences
- apply the scientific method
- employ field and laboratory technical skills related to plant biology
- record and collect experimental data and summarize the results
- develop problem solving, presentation, communication and team-work skills

Course Content: The students are expected to conduct a small group project to cover different aspects (morphological, anatomical, physiological, biochemical and ecological) of how plants respond in different environments based on the knowledge they gained during Level I and Level II BT courses. Several guided lectures will be conducted on phenotypic plasticity, eco-physiology, ecological anatomy, and biochemical adaptations of plants commonly observe around us. The project/s will be supervised by one or more academic staff members. Field visit/visits will be conducted to observe the different plant responses/adaptations and for data collection. Students will be engaged in laboratory work if necessary. At the end of the course the students in each group shall prepare a poster and present their poster.

Method/s of Evaluation: End of semester theory/practical based examination (50%), group presentation (30%) and a poster (20%).

Recommended reading:

- Text books, undergraduate research project reports, laboratory manuals etc. relevant for the given topic under investigation.

Course Code and Title: BT 3001: Plant Pathology

Credit Value: 3C (30L 30P)

Rationale: The course covers fundamental aspects, emerging concepts and practices of plant pathology while providing students with skills necessary to diagnose and manage common pests and diseases of important crops. The course will provide knowledge and skills to diagnose plant diseases, comprehend the influence of environment, biological, genetic and cultural factors on diseases, and design and implement suitable management strategies to mitigate plant diseases.

Pre-requisites: BT 1012

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate an understanding on basic concepts of plant pathology and recognize the fundamental importance of disease management.
- identify biotic and abiotic agents that cause plant diseases and the types of symptoms they cause.
- assess environmental, biological, genetic and cultural factors influencing plant disease development
- apply suitable isolation and identification methods for accurate diagnosis of plant diseases.
- appraise different methods and design appropriate disease management strategies.

Course Content: Introduction: Concept of disease, symptoms and types of diseases; Procedures in diagnosis of plant diseases: Infectious and non-infectious diseases, Kochs' rules; Causative agents of plant diseases: Fungi, bacteria, mollicutes, viruses and viroids, nematodes; Parasitism and disease development: Parasitism and pathogenecity, disease triangle, diseases cycle / infection cycle; How pathogens attack plants: Mechanical forces, microbial enzymes and toxins, growth regulators; Effect on physiology of host; Defense mechanisms of plants: Pre-existing and induced defenses; Genetics of plant diseases: Genes and disease, development of resistant varieties; Environment and plant disease: Effect of temperature, moisture, wind, light, soil pH and structure, nutrition, herbicides; Plant disease epidemiology: Elements of an epidemic, development and patterns of epidemics, comparison of epidemics, forecasting and simulation of epidemics; Control of plant diseases: Exclusion, eradication, immunization and developing resistance, direct protection, integrated control; Diseases of important crop in Sri Lanka; Emerging concepts.

The practical component covers techniques in isolation, purification and identification of plant pathogenic fungi and bacteria, nematode isolation and identification, examination of Koch's postulates, antimicrobial assays, study of plant diseased material, bio control and discussion of relevant publication and case studies.

Method/s of Evaluation: End of semester theory (65%) and practical (35%) examinations.

Recommended Reading:

- Agrios, G. N. (1997 and 2005).Plant Pathology. Academic Press.

Course Code and Title: BT 3002: Horticulture

Credit Value: 3 C (30 L 30 P)

Rationale: This course introduces students to the basics of horticulture. The course will provide an overview of global and national importance of horticulture while identifying applications and potentials in developing horticulture industry in Sri Lanka. Opportunities will be provided through relevant practicals, group activities and field visits to develop competence in essential horticultural techniques.

Pre-requisites: None

Intended Learning Outcomes: After completion of the course students should be able to;

- explain the importance of horticulture locally and globally
- recognize the branches of horticulture
- demonstrate basic horticultural practices
- analyze the importance of greener and sustainable horticulture for the future

Course Content: Introduction: Impact of Horticulture, brief history, horticultural classification, horticultural crops, economic importance; Essentials of Nursery Management: Soil management - garden soil, physical and chemical properties of soil, organic matter, compost, maintenance of soil condition; Cultural practices; Water management- water quality, irrigation, mulching; Nursery structures, Protected environment cultivation: Controlled Environment Agriculture (CEA) concept, controllable variables, CEA technologies – hydroponics, aquaculture; Growing media and Media Mixes : Loam – based and non-loam based media, heat and chemical treatment of growing media, container-growing; Use of manures and fertilizers; Organic farming; Environment factors; Growth control in horticultural crops: Physical control- pruning and training; biological control- graft combination; chemical control (use of plant growth substances); Essentials of plant propagation; Plant improvement; **Future of horticulture in Sri Lanka:** Landscape horticulture, climatic and natural diversity of indigenous vegetables, fruits and ornamental plants of Sri Lanka, Impacts of use of exotic plants, new crops etc.; Commercial Horticulture: horticultural production systems, orcharding, vegetable farming, floriculture; Ornamental gardening; Landscape horticulture; Amenity horticulture; Post harvest technology of horticultural crops (fruits/ vegetables and cut flowers)

Method/s of Evaluation: End semester theory paper (70%) and practical assessment (20%); Group projects and/ presentation (10%)

Recommended Reading:

- Janick, J. 1986. Horticultural Science. W.H Freeman (4th ed.)
- Acquaah, G. 2008. Horticulture: Principles and Practices. Pearson (4th Ed.)
- Toogood, A. 1999. American Horticultural Society Plant Propagation: The Fully Illustrated Plant-by-Plant Manual of Practical Techniques Hardcover (American Horticultural Society Practical Guides series. Publisher – DK)

Course Code and Title: BT 3003: Plant Molecular Biology

Credit Value: 2 C (30 L)

Rationale: This course aims to provide students with in-depth understanding of fundamental aspects of molecular biology in plants, with an emphasis on eukaryotic nuclear genome complexity, gene transfer methods and applications, and different types of molecular markers used in plant-based research. Understanding of fundamental molecular biology concepts has an applicative value in a range of fields including plant breeding and genetics, and plant systematics. Thus, this course is intended for students who are interested in molecular biotechnology.

Pre-requisites: BT 2015 course is recommended.

Intended Learning Outcomes: After successful completion of this course, students will be able to;

- discuss the genome complexity of eukaryotes
- compare different molecular marker systems
- describe the gene transfer methods applicable to plants
- assess the advantages and limitations of different gene transfer methods
- critical appraisal of scientific literature relating to the course content

Course Content: Nuclear genome complexity of eukaryotes: types of DNA sequences (repetitive DNA, satellite DNA (minisatellites (Variable Number Tandem Repeats (VNTRs), microsatellites (Short Tandem Repeats (STRs)), transposable elements, gene families, etc.); Different classes of molecular markers (Isozymes, Restriction Fragment Length Polymorphism (RFLP), Randomly Amplified Polymorphic DNA (RAPD), Amplified Fragment Length Polymorphism (AFLP), Microsatellites (Simple Sequence Repeats (SSRs), Inter-Simple Sequence Repeat (ISSR), and Single Nucleotide Polymorphism (SNP)) and applications (fingerprinting, sex determination etc.); Gene transfer methods in plants (vector-mediated gene transfer (Agrobacterium-mediated gene transfer, virus mediated-mediated gene transfer) and vector –less gene transfer (physical and chemical gene transfer methods including electroporation, particle bombardment, microinjection); Applications of gene transfer technology in plants.

Method/s of Evaluation: End of semester written examination (80%) and in-class assignment (20%)

Recommended Reading:

- Grierson, D.and Covey, S. N. (Eds.). 1988.Plant molecular biology: tertiary level biology. New York: Springer Science business media, LLC.
- Lodish, H., Berk, A., Baltimore, D., Matsudaira, P., Zipursky, S. L. and Darnell, J. (2000). Molecular cell biology. New York: W. H. Freeman.
- Watson, J. D., Gilman, M., Witkowski, J., and Zoller, M. (1992). Recombinant DNA. New York: W. H. Freeman.
- **Caudy, A. A., Myers, R. A., Watson, J. D., WitkowskiJ. A. (2006). Recombinant DNA: genes and genomes: ashort course. New York: W. H. Freeman.**
- Reviews and recent journal articles relevant to the subject

Course Code and Title: BT 3006: Plant Tissue Culture Technology**

Credit Value: 3 C (30 L 30P)

Rationale: This course will provide under-graduate level knowledge and practical skills in plant cell & tissue culture. This course has a vocational focus and introduces the student to the role of tissue culture in plant propagation, secondary metabolite production and crop improvement.

Pre-requisites: None

Intended Learning Outcomes: After successful completion of this course module, students will be able to;

- explain the nature of plant growth processes in the tissue culture environment
- determine appropriate culture media for different tissue culture applications
- discuss the major applications of plant cell cultures
- demonstrate competence in laboratory based techniques used in tissue culture
- apply concepts of tissue culture to select, manage and improve plants and their products and determine commercial applications
- design a layout for a commercial tissue culture facility

Course Content: Introduction and background; Historical aspects of plant tissue culture and definitions; Tissue culture techniques: Sterile techniques, media components and preparation, regulation by plant growth regulators, environmental effects and acclimatization; Cell growth and differentiation in plant cultures: cell cycle, population dynamics, growth patterns, differentiation, organogenesis, somatic embryogenesis, somaclonal variation; Culture types and applications: undifferentiated cell masses, callus formation and establishment of plants, induction of variability through mutations/transformation, cell suspension cultures, secondary metabolite production (principles and technology applied during pharmaceutical/ pigment/beverage production), organ culture, meristem culture, shoot culture, anther and microspore culture, homozygous line production, protoplast culture, micropropagation, somatic embryogenesis and artificial seeds, embryo rescue and wide-hybridization, tissue culture as a method for germplasm conservation; Commercial Plant cell and tissue culture: Concept of commercialization, designing of a commercial tissue culture laboratory, laboratory management.

Method/s of Evaluation: End of semester theory examination (70%) and practical examination and/or assignments (30%).

Recommended Reading:

- Plant Tissue Culture 3rd edition, Techniques and Experiments (Roberta Smith) 2013
- Smith R. H. (2013). Plant tissue culture-techniques and experiments, Third edition. Academic Press, New York, USA.
- Doods J.H. and Roberts, L.W. (1985). Experiments in plant tissue cultures, Second Edition, Cambridge University Press, Cambridge, UK.

- Razdan M. K. (2003). Introduction to plant tissue culture. Science Publishers Inc. Enfield, New Hampshire, USA.
- Thorpe T. A. (1981). Plant tissue culture methods and application in agriculture. Academic Press, New York, USA.

Course Code and Title: BT 3008: Intellectual Property Rights **

Credit Value: 1 C (15 L)

Rationale: This course is designed to introduce basic concepts of the legal environment for commercializing innovations and patent litigation process in Sri Lanka.

Pre-requisites: None

Intended Learning Outcomes: After completion of the course students should be able to;

- explain the importance of Intellectual Property (IP) in the knowledge economy
- identify various categories of IP rights
- explain the process of obtaining a patent in Sri Lanka
- undertake prior art search and patent drafting
- recognize the value of IP as a strategic tool in the business world

Course Content: Introduction to Intellectual Property (IP);The nature, type of IP: patents, trademarks, copyrights, Integrated Circuit (IC) topologies, proprietary databases; Patents: patentability requirements, novelty, usefulness and non-obviousness; Study of IP Act in Sri Lanka and overseas; Patentability requirement case studies**;** Prior Art Searches: need and example prior art searches; Application for Patents**:** precautions to be taken in the process, local applications, priority date; Patent Cooperation Treaty system, foreign applications, patent granting procedure; Patent drafting: drafting patent specification and claims; Legal issues of IP: infringement, validity, case studies.

Method/s of Evaluation: End of semester theory examination (100%)

Recommended Reading:

- www.wipo.int/
  - WIPO Publications (can be freely downloaded from WIPO website):
  - Your own world of IP
  - Inventing the future – An Introduction to patents for small and medium sized enterprises
  - Learn from the Past, Create the future: Inventions and Patents
  - WIPO Patent Drafting Manual
- Freely accessible online patent databases:
  - PATENTSCOPE
  - Espacenet
  - Google Patents
  - USPTO Patent database

Course Code and Title: BT 3009: Environmental and Biodiversity Related Legislation in Sri Lanka**

Credit Value: 1 C (15 L)

Rationale: This course provides an overview of the legislation related to the protection of the biodiversity and environment in Sri Lanka. Basic principles of international environmental law will also be introduced in the context of the multilateral environmental agreements to which Sri Lanka is a party. The course further elaborates on the current issues related to implementation of law and related policy.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- describe the history and development of environmental and biodiversity legislation
- discuss basic principles of national and international environmental law
- apply legal principles for given case studies
- summarize relevant multilateral environmental agreements
- evaluate the current implementation of environmental and biodiversity legislation in Sri Lanka

Course Content: Rationale for protection of species and ecosystems of Sri Lanka; The history and development of environmental and biodiversity legislation; Multilateral environmental agreements that protects species and the environment; General principles and rules of national legislation and their amendments: Ordinances, Acts and Policies that protect environment and biodiversity of Sri Lanka; Issues involved in enforcement of environmental and biodiversity legislation in Sri Lanka: infringement, validity and case studies.

Method/s of Evaluation: End of semester theory examination

Recommended Reading:

- Compendium of summaries of judicial decisions in environment related cases (2005). Division of Policy Development and Law, United Nations Environment Program. ISBN 92-807-2566-1
- Selected Sri Lankan legislative enactments

Course Code and Title: BT 3053: Introduction to Bioinformatics

Credit Value: 2C (15L 30P)

Rationale: This course introduces students to key concepts and methods or tools in Bioinformatics to store, retrieve, analyze and interpret genomic and proteomic data. Students are provided with hands-on experience in basic bioinformatics tools and databases that are required to solve problems in different fields of biology.

Pre-requisites: None

Intended Learning Outcomes: At the end of the course you should be able to;

- demonstrate knowledge of fundamental concepts and tools in bioinformatics
- discuss the importance and applications of bioinformatics
- identify, access and utilize appropriate bioinformatics data resources to solve biological problems
- design and perform analyses using bioinformatics tools and databases, and interpret outcomes

Course Content: Introduction: definitions, the need and development of databases and tools for analysis, interpretation of biological data. Relevance and applications of Bioinformatics; Databases and Tools: Categorization of databases, types of data stored, Nucleic acid sequence databases, protein sequence databases, protein structure databases, Databases at NCBI, database formats, sequence formats, NCBI and EMBL formats, sequence retrieval, database search tools, similarity search with BLAST family of tools, sequence analysis software for pair-wise and multiple sequence analyses (ClustalW, MUSCLE), detecting open reading frames (ORF, BIOEDIT), restriction mapping, DNA sequence assembly and Primer design; Sequence alignment: underlying principle, process of sequence alignment, applications, pairwise and multiple sequence alignment, commonly used alignment tools; Genome analysis: genomes, genome sequencing, assembly and annotation, applications; Protein Information Resources: protein sequence and pattern databases, protein structure databases; Applications of bioinformatics in protein analysis and proteomics: protein sequence and structure analysis tools, UniProt/SwissProt Knowledge Base, ExPASy proteomics server, bioinformatics for functional proteomics-e.g. applications in protein 2-DE, 3-D structure prediction using Rasmol; Bioinformatics and drug design.

Method/s of Evaluation: End semester theory examination (70%) and practical examination (30%)

Recommended Reading:

- Introduction to Bioinformatics (Attwood, T.K. and Parry-Smith, D.J.) 1999
- Developing Bioinformatics Computer Skills (Gibbas C. and Jambeck P.) 2001; Bioinformatics - A Beginner's Guide (Claverie, J. and Notredame, C.) 2003
- Instant Notes in Bioinformatics (Westhead, D.R., Parish, J.H., Twyman, R.M.) 2003
- Fundamental Concepts of Bioinformatics (Krane, D.E. and Raymer, M.L.) 2003
- A Theoretical and Practical Approach (Krawetz, S. A. and Womble, D.D.) 2003
- Bioinformatics: Sequence and Genome Analysis (Mount, D.W.) 2004, 2nd ed.
- Internet sources

Course Code and Title: BT 3058: Bioprospecting

Credit Value: 2C (30L)

Rationale: This course intends to inculcate a deep appreciation towards biodiversity while emphasizing the benefits of commercialization of biological diversity via conservation based bioprospecting. The course will provide an understanding on the abundant genetic and biochemical resources, aspects of commercialization, methods of exploring and screening biodiversity, product development, conservation, bio-piracy and legal implications with the intention of inspiring students to adopt bioprospecting related careers.

Pre-requisites: None

Intended Learning Outcomes: By the end of this course the students will be able to,

- appreciate the invaluable genetic and biochemical resources
- recognize the benefits of commercialization of biological diversity via conservation based bio prospecting.
- examine aspects of commercialization, methods of exploring and screening biological diversity, product development, conservation, bio-piracy and legal implications in bioprospecting.
- appraise different strategies available for bioprospecting for biological resources.
- Design a comprehensive business plan to develop a product of biological origin.

Course Contents: Introduction: Biodiversity prospecting; Genetic and biochemical resources: Biochemical resources from plants and fungi, natural products, pharmaceuticals, pharmacognosy; Natural products as drugs: Natural products as modern drugs, the role of natural products in drug discovery; Prospecting for new compounds from plants: Ethnobotanical approach and screening, collecting and harvesting medicinal plants and storage, isolation of pure compounds, bio-assay guided isolation, high throughput screening of extracts; Natural products from fungi: Fungi as a source of low molecular weight pharmaceuticals, taxon specificity of secondary metabolites, habitat fidelity, sampling and treatment of material, isolation and enrichment, screening strategies; Actinomycetes as a source of bioactive compounds: Habitat variation in actinomycetes, isolation techniques, procedures for selective isolation; Conventions on biodiversity and bioprospecting: bioprospecting and biodiversity conservation; Bioprospecting agreements, bilateral and multilateral contracts, bio-piracy, legal implications, current status and application in Sri Lanka.

Method of Evaluation: End of semester theory examination.

Recommended Reading:

- Drugs of Natural Origin; A Textbook of Pharmacognosy (Samuelsson, G.)2002, 4th ed.

Course Code and Title: BT 3061: Taxonomic Field Survey

Credit Value: 3C (90P)

Rationale: This field based course is designed for the students to gain knowledge and experience on sampling and collecting plants in the field, plant identification techniques, herbarium techniques and practices, detailed botanical studies and the use of botanical literature.

Pre-requisites: BT 3066

Indented Learning Outcomes: On completion of this course unit you will be able to;

- identify botanical characters in plants using botanical terminology.
- write botanical descriptions and make detailed botanical drawings of plants.
- identify unknown plants using botanical literature and herbarium facilities
- prepare herbarium specimens and collections.
- perform taxonomic surveys on plants in a given location and report findings.

Course Content: A suitable location for the study is selected. Each student is expected to submit a herbarium collection of a specified number of different plant species (20 – 25) collected from the study site and a field report. Before the field assignment, classroom practical lessons will be conducted for familiarization of botanical terms, characters and plant identification.

Herbarium collection: Collections can include specimens from Angiosperms, Pteridophytes, Bryophytes, etc. Herbarium specimens should be mounted on herbarium paper, labeled, and identified.

Field report: Should include introduction, site description, field methodology, details of the collected plants, discussion and detailed taxonomic studies of two selected species from each student.

Method/s of Evaluation: Herbarium collection (30%), field report (50%) and a *viva-voce* examination (20%).

Recommended Reading:

- A Revised Handbook to the Flora of Ceylon: Vol. I - XV (Dassanayake, M. D., Fosbergand Clayton) 1980 – 2006
- A Field Guide to the Common Trees and Shrubs of Sri Lanka (Ashton, M. *et al*.) 1997
- A Check List of the Flowering Plant of Sri Lanka (Senaratne, L. K.) 2001.
- Illustrated Field Guide to the Flowers of Sri Lanka (Vol. 1 and Vol. 2) Jacob De Vlas, Johanna De Vlas-De Jong (2008, 2015)
- Hickey, M. and King C. (2000). The Cambridge Illustrated Glossary of Botanical Terms. Cambridge University Press

Course Code and Title: BT 3063: Techniques in Molecular Biology

Credit Value: 2 C (15 L 30 P)

Rationale: The course aims to acquaint students with principles and techniques of molecular biology. The course also allows students to conduct experiments to gain hands-on experience in a range of molecular biology techniques used in laboratories. This will strengthen the theoretical and technical skills of basic molecular biology methods.

Pre-requisites: BT 2015 and BT 3003 courses are recommended.

Intended Learning Outcomes: After successful completion of this course, students will be able to;

- describe the scientific basis underpinning the fundamental molecular biology techniques
- work safely and independently in a molecular biology laboratory
- utilize equipment and reagents, appropriately to achieve objectives
- maintain detailed lab reports with experimental objectives, procedures and discussion of results
- identify and execute strategies to overcome experimental failures
- design experiments to solve problems in molecular biology by selecting appropriate technique(s).

Course Content: Methods in molecular biology: techniques for isolation, detection, localization, and quantification of nucleic acids and proteins, gel electrophoresis, visualization, detection of nucleic acids, blotting techniques, nucleic acid hybridization, nucleic acid probes, antibodies for detection of proteins, auto-radiography and fluorography, *In situ* hybridization; Recombinant DNA techniques: restriction endonucleases and restriction mapping, DNA modifying enzymes, cloning vectors, cloning and methods for screening recombinant transformants; Analysis and uses of cloned genes: DNA sequencing, Polymerase Chain Reaction (PCR); Construction of cDNA and genomic libraries, expression libraries and screening; Applications of cloning: Recombinant protein production, genetically modified organisms.

Practical component covers the basic techniques in molecular biology.

Method/s of Evaluation: End of semester written examination (50%) and practical examination (45%), and maintenance of lab book (5%)

Recommended Reading:

- Wilson, K. and Walker, J. (Eds.) (2000). Principles and techniques of practical biochemistry. United Kingdom: University Press, Cambridge.
- Watson, J. D., Gilman, M., Witkowski, J., and Zoller, M. (1992).Recombinant DNA. New York: W. H. Freeman.
- Turner, P., McLennan, A., Bates, A. and White, M. (2005). Instant Notes in Molecular Biology. New York: Taylor and Francis Group.
- Reviews and journal articles relevant to the subject

Course Code and Title: BT 3064: Experimental Plant Biotechnology

Credit Value: 2C (60P)

Rationale: This course provides hands on experience in practical aspects of plant biotechnology to design and conduct a group project. The students are expected to evaluate relevant literature. The experience gained through the module would enable the students to address research problems/research needs, in related industries.

Pre-requisites: None

Intended Learning Outcomes: At the completion of the course the students will be able to;

- employ a range of technical, and laboratory skills relevant for plant biotechnology
- apply the scientific method
- record experimental data by maintaining a laboratory notebook and a log book.
- develop written and oral communication skills
- access and utilize the scientific literature and develop critical thinking and scientific reasoning skills
- develop team-work skills in planning, time management, decision making, problem solving, negotiation, conflict resolution, etc.

Course Content: The students are expected to conduct a group project to cover different aspects of plant biotechnology. The project will be supervised by one or more academic staff members. Laboratory work and progress will be monitored by regular meetings between the supervisor(s) and the students. A log book has to be maintained by the group and each student should maintain his/her own lab note book. At the end of the course the students shall submit a project report prepared by the group.

Method/s of Evaluation: Project report (40%) and *viva-voce* examination (60%).

Recommended reading:

- Research papers, text books, laboratory manuals etc. relevant for the given topic under investigation

Course Code and Title: BT 3066: Plant Systematics

Credit Value: 3 C (30 L 30 P)

Rationale: Plant systematics explores the origin, diversification and classification of land plants while emphasizing more on flowering plants. This course provides a broad knowledge on classification and relationships of plants with emphasis on phylogenetic approach. Practical component provides an indepth knowledge on widely distributed tropical angiosperm plant groups and their relationships.

Pre-requisites: BT 3061

Intended Learning Outcomes: At the end of the course you should be able to;

- define, explain and critically review the basic concepts in systematics.
- review different taxonomic philosophies and recognize the major approaches and concepts in biological classification.
- identify plants using scientific procedures.
- utilize different types of data for taxonomic studies
- identify the major clades of the Angiosperm Phylogeny Group (APG) classification system and the phylogenetic relationships of major plant families.
- integrate and apply knowledge on plant systematics to solve diverse research questions.

Course Content: Science of systematics: Terminology and the importance of systematics, role of plant systematists; Historical background: Pre-Linnaean to contemporary taxonomic philosophies; Different approaches, principles and concepts in biological classification: Artificial, natural, phyletic, phenetic, cladistic and the phylogenetic approaches; Angiosperm Phylogeny Group (APG) classification: Introduction to Angiosperm Phylogeny Group (APG) classification system – Features and major clades, Plant orders in basal angiosperms, monocots and eudicots (rosids and asterids), relationships and apomorphies; Plant identification and botanical nomenclature: Identification process, plant collection, herbarium preparation, plant identification keys, nomenclature systems, ICBN &Phylocode; Taxonomic data: Morphological, anatomical, embryological, palynological, cytogenetic, phytochemical, reproductive biological and ecological data; Sources of plant systematic data: Systematic literature, herbaria, botanical gardens, electronic databases; Systematics of Sri Lankan Flora: History of Sri Lankan plant systematics, work and progress.

Method/s of Evaluation: End semester theory examination (70%) and practical examination and field assignment (30%).

Recommended Reading:

- Plant Systematics: A Phylogenetic Approach, 2nd Edition (2002) – W. S. Judd, C. S. Campbell, E. A. Kellogg and P. F. Stevens.
- Plant Systematics (2006) – Michael G. Simpson.
- Plant Taxonomy (1990) - Tod F. Stuessy
- An Integrated System of Classification of Flowering Plants(1981)– Arthur Cronquist

- APG classification – http://www.mobot.org/MOBOT/research/APweb/
- The Angiosperm Phylogeny Group (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families offlowering plants: APG IV, *Botanical* Journal of the Linnean Society, 181: 1–20.

Course Code and Title: BT 3071: Experimental Design and Data Analysis

Credit Value: 2 C (15 L 30 P)

Rationale: This course provides the theoretical knowledge and practical skills needed to design biological experiments and data analysis using selected statistical tools.

Intended Learning Outcomes:

At the end of the course you should be able to;

- define and explain the basic concepts on variables, experimental errors, statistical variation, experimental designs, statistical inference, and hypothesis testing.
- explain the underlying principles of different data analysis methods.
- identify suitable experimental designs and relationships between variables.
- identify suitable data analysis methods, analyze data and make correct statistical inferences.
- employ statistical software (R and SPSS) in data analysis.

Course Content: Introduction to Experimental Designs: Types of variables, validity of an experiment, experiments vs. observational studies, biological data and basic concepts of designing scientific experiments; Different designs: One-way and multiple variable designs with different levels, between and within subject designs, factorial designs: main/interaction effects, CRD, RCBD and LSD designs, different treatment arrangements; Analysis of Variance: Concept of comparing several means, assumptions of ANOVA, logic behind and importance of ANOVA, basic steps in one-way and two-way ANOVA, mean comparison tests, practical working questions; Correlation and regression experiments and data analysis: Nonparametric statistics, Characteristics, concepts and different methods of nonparametric statistics; the sign test, Mann-Whitney *U* test, rank correlation; Multivariate analysis: Importance of multivariate statistics, different multivariate methods; cluster analysis, principle component analysis (PCA), applications of multivariate statistics in different fields in biology; Data analysis using SPSS and R – Descriptive statistics, t-test, ANOVA, correlation and regression, PCA and cluster analysis.

Method/s of Evaluation: End of semester theory examination (50%) and practical examination (50%).

Recommended Reading:

- **Jim Fowler, Lou Cohen, Phil Jarvis (1998). Practical Statistics for Field Biology, 2nd Edition, John Wiley & Sons Inc,**
- **Chap T. Le, Lynn E. Eberly (2016). Introductory Biostatistics (2nd Edition), John Wiley & Sons.**
- **Mario F. Triola (2012). Elementary Statistics (12th Edition), Pearson.**

Course Code and Title: BT 3073: Methods in Plant Breeding**

Credit Value: 2 C (20 L 20 P)

Rationale: The course is intended to familiarize the students with fundamental aspects of plant breeding, through historical perspectives to conventional and biotechnical approaches in crop plant improvement. The course will provide knowledge and skills required for identifying the natural breeding mechanisms of various crop species in order to determine the relevant breeding strategies for the development of formal breeds or varieties. The commercial aspects of plant breeding will be highlighted, particularly the development of hybrid varieties.

Pre-requisites: BT 1011

Intended Learning Outcomes: At the end of this course typical students should be able to;

- distinguish characteristics of self- and cross-pollinated plants
- determine breeding methodology appropriate for plants with different mating systems
- identify sources of genetic variation to conduct a breeding programme
- demonstrate skills at pollination and hybridization
- discuss the need and importance of plant breeding to society
- review the process of crop domestication and evolution

Course Content: History of plant breeding: Evolution and domestication of crop plants; Centers of crop origin and diversification; Plant breeding objectives. Variation in plants: Qualitative and quantitative; Introduction to quantitative genetics. Modes of reproduction in crops: Self- vs. cross pollination; Breeding self-pollinating crops: Selection applied on land race populations; mass selection and pure line selection; Selection applied on segregating generations; Bulk breeding, Pedigree breeding, Backcross breeding, Single seed descent. Breeding cross-pollinated crops; Population improvement; Hybrid variety development, inbreeding and heterosis, cytoplasmic male sterility; Marker-assisted breeding; Seed certification and release. Germplasm resources: National and international crop germplasm repositories; Global networks.

Field visits to plant breeding research stations: Hands on experience in plant breeding techniques, report writing.

Method/s of Evaluation: End of semester examination (70%) and continuous assessments/ field reports (30%).

Recommended Reading:

- Sleper, D.A. and Poehlman, J.M. (2006). Breeding field crops (Fifth edition), Wiley-Blackwell Publishers
- Brown, J. and Caligari, P. (2011). An introduction to plant breeding, Wiley-Blackwell
- Acquaah, G. (2012). Principles of plant genetics and breeding (2nd Edition), Wiley-Blackwell

Course Code and Title: BT 3105: Applied Microbiology**

Credit Value: 3 C (30 L, 30 P)

Rationale: This course is designed to showcase the application of microorganisms and their products/genes in diverse fields and the safe use of microorganisms in industry and research. Recognition of microorganisms as unseen yet vital counterparts of the biosphere, their role in maintaining ecosystem stability and their contribution for economic development are aimed at.

Pre-requisites: BT 1012 and BT 2014

Intended Learning Outcomes:

At the end of the course the students will be able to;

- design a microbiology laboratory with appropriate safety precautions
- asses and manage the risks involved with handling microorganisms
- describe the vital roles played by microorganisms in environmental processes and food safety
- apply the knowledge on microbial processes in agriculture and industry
- demonstrate the techniques used in observing and quantifying microorganisms in different habitats
- critically analyze the data generated through experimentation and interpret logically
- communicate scientific information effectively

Course content: Safety in Microbiology: hazard groups and containment levels, GILSP criteria; Handling of genetically modified microorganisms; Design and maintenance of a microbiology laboratory; Soil Microbiology: factors affecting growth and distribution of microorganisms in soil; Roles of soil microorganisms: biogeochemical cycles, decomposition; Plant-microbe interactions: rhizosphere, phyllosphere, root nodules, endophytes, mycorrhizae; Applications of plant-microbe interactions in agriculture: biofertlizers, biological control agents; Food Microbiology: factors affecting food spoilage, principles of food preservation, food-borne diseases and food poisoning, microbiology of milk and dairy products; Environmental microbiology: potable water treatment, wastewater and solid waste treatment, composting and biogas production, bioremediation, bioleaching; Industrial Microbiology: Industrial microorganisms: Isolation and strain improvement, culture collections; Microbial process development: Upstream processing, fermentation, downstream processing; Product development, regulations and safety: product quality, manufacturing and safety.

Practical Component: Laboratory sessions relevant to the theory taught and field visits

Method/s of Evaluation: End of semester theory and practical examinations (80%) and assignments (20%)

Recommended Reading:

- Madigan, M.T., Martinko, J.M., Bender, K.S., Buckley, D.H., Stahl, D.A. and Brock, T (2014). Brock Biology of Microorganisms (14th Edition). Pearson

- Anderson, N. and Pearsall, R. (2004). Microbiology – A Human Perspective (4th Edition). McGraw-Hill Education.
- Cappuccino, J.G. and Sherman, N. (2001). Microbiology- A Laboratory Manuel (6th Edition) Benjamin-Cummings Pub Co.

Course Code and Title: BT 3167: Phylogenetic Analysis**

Credit Value: 1 C (10 L 10 P)

Rationale: The use of phylogenetic methods to reconstruct the evolutionary history using molecular sequences is a vital part of biological research today. To carry out phylogenetic analysis, it is necessary to have a good understanding of the strengths and weaknesses of the key methods and approaches. This course deals with the analysis of multiple molecular sequences at different levels (populations, species, clades, communities) and provides the theoretical and practical skills needed to carry out state-of-the-art phylogenetic analyses.

Pre-requisites: BT 3003

Intended Learning Outcomes: At the end of this course the students will be able to;

- define, explain and describe the basic concepts in phylogenetics and molecular phylogenetic analysis
- identify and select suitable molecular markers and methods for different phylogenetic studies.
- analyze DNA sequence data using commonly used analytical methods and construct phylogenetic trees.
- evaluate phylogenetic trees using statistical methods.
- integrate and apply knowledge to diverse research questions related to phylogeny and demonstrate interpretation skills.

Course Content: Introduction to phylogenetics: concepts of evolution, phylogenetics and molecular phylogenetics, phylogenetic trees, phylogenetic studies and controversies in phylogenetic analysi; Molecular data in phylogenetics: Different techniques and data in molecular phylogenetic studies (RAPD, AFLP, SSR, and DNA sequencing etc.), applications and limitations of the techniques; Phylogenetic analysis methods: Distance and character state methods, Neighbor Joining, Maximum Parsimony, Maximum Likelihood and Bayesian analysis; Phylogenetic trees and the concepts; Bootstrapping; Applications of phylogenetic analyses: Organismal phylogeny, evolutionary biology, character evolution, timing evolutionary trees, phylogeographic and biogeographic studies and implications.

Method/s of Evaluation: End semester theory examination (70%) and in class assignments (30%).

Recommended Reading:

- Page, R. D. M. and Holmes, E. C. (1998). Molecular Evolution: A Phylogenetic Approach
- Felsenstein, J. (2004). Inferring Phylogenies
- Hall, B. G. (2001). Phylogenetic Trees Made Easy
- Hills, D. M., Moritz, C. and Mable, B. K. (1996). Molecular Systematics (2nd Edition) Sinauer Associates, Inc

Course Code and Title: BT 3170: Aspects of Environmental Science**

Credit Value: 2 C (20 L 20 P)

Rationale: This course focuses on managing the interactions of humans and the environment with an emphasis on the sustainable use of natural resources. It further provides an overview of the challenges faced by the environment at present. Various environmental decision making tools are introduced along with mitigation methods to overcome environmental issues.

Pre-requisites: EN 1008

Intended Learning Outcomes: At the end of this course the students will be able to;

- describe the interactions of humans with the environment and the ensuing issues
- discuss the causes and possible mitigation methods for current environmental challenges
- apply environmental decision making tools
- develop solutions for environmental problems
- select, summarize and communicate relevant information related to environmental issues

Course Content: Renewable and non-renewable natural resources; Human interactions with the environment: impact of different civilizations, over exploitation, population increase with regard to Sri Lanka; Current environmental challenges, their causes and possible solutions: environmental degradation, pollution, global climate change; Mitigation and management of environmental issues: concept of sustainable development, cleaner production, green technology, environmental quality standards, monitoring and environmental management systems; Environmental decision making tools: cost benefit analysis, Environment Impact Assessment, life cycle analysis; Basic environmental economics.

Method/s of Evaluation: End of semester examination and assignments

Recommended Reading:

- Miller, G.T. and Spoolman, S.E. (2013). Environmental Science (14th Edition). Brooks Cole

Course Code and Title: BT 3172: Special Topics in Bioinformatics**

Credit Value: 3 C (90 P)

Rationale: The course aims to allow students to develop bioinformatics programming skills that are necessary for exploration of complex and large biological data to address biological questions through modern bioinformatics approaches.

Pre-requisites: BT 3053

Intended Learning Outcomes: After successful completion of this course module, students will be able to;

- exploit widely used programming languages and software in Bioinformatics
- compose applicable bioinformatics programs for biological data analysis
- apply bioinformatics programming and computational methods for hypothesis testing in research
- perform computational analysis of biological data
- discuss how bioinformatics methods can be used to solve biological problems

Course Content: Introduction to MATLAB, problem solving based on MATLAB, Programming languages and advanced software used in bioinformatics, biological and numerical data interpretation and manipulation using algorithms. The course is heavily lab-oriented and will cover topics related to bioinformatics programming and computational biology.

Method/s of Evaluation: End semester examination (70%) and continuous assessments (30%)

Recommended Reading: Relevant literature will be provided at the beginning of the course

Course code and Title: BT 3901: Fundamentals of Landscaping**

Credit Value: 3 C (30 L 30 P)

Rationale: This course is designed to understand basic principles of landscaping through exploring visual, perceptual, and spatial qualities of different landscapes. Specific design aspects of landscapes with respect to nature, culture, historical importance are addressed in this course. The course will also provide basic graphical skills and communication of design ideas to the learners.

Prerequisites: None

Intended learning outcomes: After completion of the course students should be able to;

- explain basic principles, concepts and elements of design
- recognize scale, shadow and shade components of designs
- design and sketch 2D and 3D drawings of landscapes
- appreciate landscape designs and garden types

Course Content: Basic landscape principles: introduction to elements of landscapes, design theory and analysis, design concept development through field observations of cultural, historical, natural and transformed landscapes; Development of images, two and three dimensional drawings.

Method/s of Evaluation: Continuous in-class assignments based on concept identification, illustrations and designs.

Recommended Reading:

- Booth, N. (1990). Basic Elements of Landscape Architectural Design. Waveland Press Inc.
- Elam, K. (2001). Geometry of Design: Studies in Proportion and Composition. Princeton Architectural Press

Course code and Title: BT 3902: Landscaping Assignment**

Credit Value: 2 C (60P)

Rationale: This course provides the learners hands on experience in landscaping of a particular location starting with site appreciation and analysis, selection of soft and hard landscape material and identification of management requirements.

Pre-requisites: None

Intended Learning Outcomes: After completion of the course students should be able to;

- recognize the suitability and challenges of garden landscaping
- identify functional, ecological and aesthetic uses of landscape material
- plan and assemble soft and hard landscape elements into an appropriate design
- identify requirements for maintenance of the landscape

Course Content: Students will be requested to landscape a given location within a given period of time. They will be guided to identify real challenges of the site with regard to weather, soil, moisture, heat and disturbances, and establish an ecologically sound landscape using hard and soft landscape material.

Method/s of Evaluation: Project proposal (20%), early, mid and end of project assessments based on landscaping work progress (60%) and viva-voce examination (20%).

Recommended Reading:

- Smith, G. (2010). From Art to Landscape: Unleashing Creativity in Garden Design, Timber Press
- Ingels, J.E. (2009). Landscaping Principles and Practices (5th ed.), Delmar Publishers

Course Code and Title: BT 3903: Pest and Plant Disease Management**
Credit Value: 2 C (15 L 30 P)
Rationale: The course intends to cover fundamental aspects and emerging concepts and practices of plant pathology and entomology while providing students with skills necessary to diagnose and manage common pests and diseases of horticultural (commercial, landscape and amenity) crops. The course will provide knowledge and skills to diagnose plant pests and diseases problems, comprehend the influence of environment, biological, genetic and cultural factors on pests and diseases and design and implement suitable management strategies to control pests and diseases in horticultural crops.
Pre-requisites: BT 1012
Intended Learning Outcomes: By the end of this course the students will be able to;

- recognize the fundamental importance of pest and disease management in horticultural crops and landscaped gardens/parks.
- identify biotic and abiotic agents that cause plant diseases.
- compose common issues of insect pests and diseases in horticultural crops on the basis of symptoms and signs.
- apply suitable isolation and identification methods for accurate diagnosis of pests and diseases.
- assess environmental, biological, genetic and cultural factors influencing plant pest and disease development.
- appraise different methods available to manage or control plant diseases and pests, and design an appropriate integrated pest and disease management strategy.

Course Content: Fundamentals of Plant Pathology: Objectives, concept of disease in plants; Types of plant diseases; Symptoms and signs; Diagnosis, isolation and identification of pathogens: Koch's postulates, isolation of fungi, bacteria, virus and nematodes; Disease triangle: Impact of environment, host and pathogen; Environment stress and plant disorders; Measurement of plant diseases; Plant disease management: exclusion and eradication of pathogen, resistance of plants, direct protection of plants, legislations and regulations; Disease management in organic farming and protected structures/greenhouses; Emerging concepts and practices; Diseases of important horticultural crop plants caused by fungi, bacteria, viruses and nematodes. Fundamentals of Entomology; Identifying insect pests and vectors: Sampling and monitoring, insect orders, important insect pests and vectors of horticultural crops in Sri Lanka; The causes of insect pests and vectored disease outbreaks: Population biology, abundance; Non-insect pests; Pest management: Physical, biological and chemical methods, Integrated Pest Management (IPM), legislation and regulation; Pest management in organic farming and protected structures/ greenhouses.

Method/s of Evaluation: End of semester theory (65%) and practical examinations (35%).
Recommended Reading:

- Agrios, G.N. (1997) and (2005). Plant Pathology, Academic Press.
- **Buczacki, S.T. and Harris, K. (2014). Pests, Diseases and Disorders of Garden Plants, 4th Edition, William Collins**

Course Code and Title: BT 3904: Commercial Horticulture and Floriculture**

Credit Value:4 C (45 L 30 P)

Rationale: This course introduces students the basic concepts of horticulture and floriculture. Students will use the opportunities provided through practicals, field visits and assessments to develop competence in subject matter as well as interpersonal, creative, and presentation skills.

Pre-requisites: None

Intended Learning Outcomes: After completion of the course students should be able to;

- explain the importance of horticulture locally and globally
- recognize the branches of horticulture and demonstrate basic horticultural practices
- analysis of the importance of greener and sustainable horticulture for the future

Course Content: Introduction to horticulture: origin and history, branches: Floriculture, Pomology, Olericulture, medicinal plants, ornamentals; Soil, nutrient and water management in plant nurseries; Greenhouse culture, hydroponics and organic farming; Aspects of commercial horticulture: orcharding, vegetable and ornamental, gardening; Floriculture: production techniques of foliage and flowers: roses, orchids, gerberas and anthuriams for domestic and export markets; Harvesting and postharvest handling of horticultural crops and cut flowers; Future of horticulture and floriculture in Sri Lanka

Method/s of Evaluation: End of semester theory examination (70%), practical assessment (20%) and group project and presentation (10%)

Recommended Reading:

- Janick, J. (1986). Horticultural Science, Publisher: W.H Freeman

Course Code and Title: BT 3905: Plant Propagation**

Credit Value:3C (15 L 60 P)

Rationale: This course will introduce the basic principles and methods of plant propagation. It will provide knowledge on environmental factors affecting plant propagation, and on different types of growing media. The students will learn various propagation techniques. This course will give the students skills in general plant propagation necessary for various sectors of horticulture industry and for home gardening.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- define terms related to plant propagation and explain basic concepts
- evaluate the conditions of a propagation environment
- prepare growing media
- apply and demonstrate various propagation methods appropriate for different plant species
- troubleshoot propagation problems

Course Content: History and evolution of plant propagation; Objectives, definitions and concepts; Biology of propagation (plant life cycles, anatomy of plant organs), Managing a plant propagation environment; Preparation of growing media/rooting media and media mixes, Propagation by seed and its advantages: seed treatments, processing and storage, sowing, transplanting of seedlings, special seeds such as hybrid seeds, orchid seeds and artificial seeds; Vegetative propagation and its advantages, methods: cloning, regeneration, use of specialized vegetative structures, cuttings, layering, grafting and budding techniques.

Method/s of Evaluation: End of semester theory examination (50%), practical examination and/or continuous assessments (50%)

Recommended Reading:

- Hartmann, H.T., Kester, D. E., Davies, F.T. Jr., Geneve, R.L. (2010). Plant Propagation: Principles and Practices (8th ed.), Pearson
- McMillan, P.D.A. and Beazley, M. (1992). Plant Propagation

Course Code and Title: BT 3906 Computer Applications in Landscape Design**

Credit Value: 3 C (90 P)

Rationale: The course emphasizes on landscape design development using software tools. The elements of the environment will be explored at regional and localized scales using appropriate software tools. Learners will be trained to combine how theoretical knowledge of subject matter could be blended with information technology.

Pre-requisites: None

Intended Learning Outcomes: After completion of the course students should be able to;

- utilize computer based tools for land-use planning and landscaping
- acquire technical knowledge on concepts and applications of Geographic Information Systems (GIS) and describe, relate and integrate environment characteristics at regional scale
- articulate landscape elements of a particular location into a design using related computer software and develop a digital version of a garden layout plan

Course Content: The students will follow the widely applied land-use planning tool, Geographic Information Systems (GIS), to describe structure and function of landscape elements in macro scale. Freely available (online) software for landscaping, for example, Realtime Landscaping Architect, Realtime Landscaping Pro, Realtime Landscaping Plus, and Realtime Landscaping Photo will be used to integrate landscape elements to develop a landscape design for a particular location.

Method/s of Evaluation: Continuous in-class assignments (50%) and Assessments (50%) evaluating individual skills on GIS mapping and interpretations, and landscape designing using software tools.

Recommended Reading:

- **Jensen, J.R. (2006). Remote Sensing of the Environment: An Earth Resource Perspective (2nd Edition), Pearson Publishers.**
- **Free software available online [(http://www.victoriana.com/landscape-design/3Dlandscapedesignsoftware.html)]**

Course Code and Title: BT 3907: Amenity and Therapeutic Horticulture**

Credit Value:3 C (30 L 30 P)

Rationale: The course provides background knowledge on the present day needs and approaches in creating amenity green spaces to support learning, movement, sensory nurturance, and reconciliation, as well as to improve health and well being of people. Students are provided with opportunities to interact with diverse communities and analyze the current status and the need of amenity and therapeutic horticulture in Sri Lanka.

Pre-requisites: None

Intended Learning Outcomes: After completion of the course students should be able to;

- explain the importance of amenity environment and health benefits of therapeutic gardens
- explore the potential expansion of amenity and therapeutic horticulture industry in Sri Lanka
- analyze and use information effectively and communicate ideas

Course Content: Definitions, scope and branches of 'Amenity horticulture' and 'Therapeutic horticulture'; Benefits to the society: recreation, human health and well-being, therapeutic values of garden environments, economic benefits through tourism, etc., ecological benefits, landscaping for conservation; Planning, implementation and sustenance of public open spaces, community gardens parks and gardens, arboriculture, wildlife gardening, sports turfs and lawns, green roofs/green walls/vertical gardens, interior plantscaping, social needs and legal concerns; Amenity and therapeutic horticulture in Sri Lanka: past, present and future.

Method/s of Evaluation: End of semester examination (70%) and assignments (30%)

Recommended Reading:

- Dixon, J.R. and Aldous, D.E (eds) (2014). Horticulture: Plants for People and Places, Volume 3 (Social Horticulture), Springer Netherlands
- Marcus, C.C. and Sachs, N. (2014). Therapeutic Landscapes: An evidenced based approach to designing healing gardens and restorative outdoor spaces, John Wiley and Sons, New Jersey
- Wagenfeld, A. and Winterbottom, D. (2015). Therapeutic Gardens: Design for Healing Spaces

** Detail syllabi approved by the CDEC (in the form of new format)

Course Code and Title: BT 4018: Soil Science

Credit Value: 2 C (15L 30P)

Rationale: This course gives fundamental information about the physical, chemical and biological properties of soil. Applying of such knowledge in soil management aimed at improving soil and crop health, crop production and erosion control will be discussed in detail. A basic idea about origin of soil, soil types and classification systems will also be given.

Pre-requisites: None

Intended Learning Outcomes: At the end of the course the students will be able to;

- describe the process of soil formation
- describe soil properties, mineralogy
- assess important physical and chemical parameters of soil
- develop solutions to problems associated with soil with respect to land use
- develop skills in soil sampling
- classify soil based on soil properties

Course Content: Origin, formation of soil and components, soil profile; Physical, chemical and biological properties of soil: Mineral fractions, CEC, base saturation, soil pH, salinity, soil colour, etc.; Soil organic matter: Classification and functions; Soil mineralogy: Crystal formation, clay minerals, ion fixation in clay and mineral soils, soil remediation based on element fixation, degradation of anthropogenic organic chemicals in soil; Soil sampling: Sampling plans and techniques; Soil erosion and soil conservation; Classification systems and nomenclature of soil; Soils of Sri Lanka

Practical component to understand soil properties and perform soil tests for nutrient management

Method/s of Evaluation: End of semester theory and practical examination and Assignments

Recommended Reading:

- The Nature and Properties of Soil (Brady, N.C. and Weil, R.R.) 1996
- A Textbook of Soil Analysis (Barthakur, H.P. and Baruah, T.C.) 1999.
- Principles of Soil Chemistry (4th Edition) Kim H. Tan (2010).
- Physical and Chemical Methods in Soil Analysis (2nd Edition) DipakSarkar and AbhijitHaldar (2010)

Course Code and Title: BT 4019: Statistical Methods in Bioinformatics **

Credit Value: 1 C (10 L 10 P)

Rationale: This course provides in-depth understanding of selected statistical principles and techniques used in the field of bioinformatics. Students are provided with practical skills together with theoretical background of statistical tools that can be used in data analysis in bioinformatics.

Pre-requisites: BT 2001 and BT 3071

Intended Learning Outcomes: At the end of this course the students will be able to;

- perform computational analysis of biological data using statistical procedures
- link the appropriate statistical toolsto bioinformatics problems
- analyse, interpret and report results accurately
- **employ R statistical software for computations and graphics**

Course Content: Introduction to R and Bioconductor: basic functionality and usage with examples; multivariate statistics and dimension reduction: more on Single Value Decomposition (SVD), Principal Component Analysis (PCA) and Supervised Dimension Reduction (SDR); analysis of ChIPseq experiments using a Bioconductor pipeline.

Practical component will cover the statistical data analysis using R statistical package.

Method/s of Evaluation: End of semester examination (50%) and assignments (50%).

Recommended Reading:

- Ewens, W.J. and Grant, G.R. (2005). Statistical Methods in Bioinformatics: An Introduction (Statistics for Biology and Health) 2nd Edition, Springer

Course Code and Title: BT 4020: Agro-biotechnology

Credit Value: 3C (30L 30P)

Rationale: The course focuses on basic principles, and selected applications of biotechnology and other modern technologies for improving agricultural crops. This course offers students a theoretical understanding of technologies and practical examples as to how technologies are used in agricultural systems.

Pre-requisites: BT 3006

Intended Learning Outcomes: Upon successful completion of this course the student will be able to:

- define concepts andprinciples of agrobiotechnology
- describe processes used in agrobiotechnology
- explain the major practical biotechnologies aimed at solving food production problems.
- discuss the benefits and challenges faced in agrobiotechnological applications

Course Content: Introduction and definitions; Application of modern plant biotechnologies in agriculture: Applications of plant transformation and transgenic crops, Common genetically modified (GM) crops, Safety testing and government regulations for GM crops, different viewpoints on GM organisms (GMOs) and GM food (GMFs); Polyploidy, RNA interference, and map based cloning in crop improvement; Phytohormones in biotechnology and agriculture: Controlled use of plant growth regulators in commercial cultivation and their effects; Plants under stress: Importance of stress tolerance and avoidance, physical, biological and genetic control of physiology of stress and hardiness; Use of modern applications for commercial agriculture: weather prediction, yield prediction and modelling, smart fertilizer application, irrigation.

Method/s of Evaluation: End of semester theory examination (70%) and practical examination and/or assignments (30%).

Recommended Reading:

- Plant Physiology. Taiz L. and Zeiger E. (1991)
- Biotechnology in Agriculture. Bajaj Series (Vol 1- 20) 1990-1999
- Plant Biotechnology and Agriculture -Prospects for the 21st Century. ArieAAltman and Paul Hasegawa (2011)

Course Code and Title: BT 4021: Biotechnology Industry

Credit Value: 3 C (30 L30 P)

Rationale: The course introduces the applications of biotechnology for sustainable production of bio-based compounds from renewable sources.

Pre-requisites: BT 3003, BT 3063, BT 3105

Intended Learning Outcomes: Upon successful completion of this course, students will be able to;

- define terms related to biotechnology industry
- distinguish among red, green and white biotechnologies
- discuss the current trends in the use of biotechnology in industry
- explain the benefits gained through biotechnology industry
- use multiple sources of scientific literature to find, evaluate and analyse information related to biotechnology industry

Course Content: Introduction to industrial biotechnology: Technology and its components, sustainable industry, university-industry collaboration; Fermentation technology: Fermentor operation, downstream processing, pilot scale production; Biotechnology in chemical industry: chemical synthesis through biotechnology, environmental benefits and economic gains; Environmental biotechnologies: Biosensors, pollution control, phytoremediation, modern applications; Genetically Manipulated Organisms and products: GM Foods and current global situation, pharmaceuticals, biopharming; Biotechnology in developed and developing countries: Current applications, regulatory issues, patent issues; Management of biotech related industries; Quality standards; Industrial safety rules and regulations; Potential biotech industries for Sri Lanka; Current status in developing countries
Field visits will be made to relevant biotechnology based industries

Method/s of Evaluation: End of semester theory examination (70%) and in-class/practical assignments (30%)

Recommended Reading:

- Soetaert W, Vandamme EJ (2010) Industrial biotechnology. Sustainable growth and economic success. Wiley VCH, Weinheim
- Reviews and recent journal articles relevant to the subject

Course code and title: BT 4022: ECOLOGY

Credit value: 3C (30L 30P)

Rationale: This course provides conceptual and theoretical background to explain the variations in abundance and distribution of plants in spatial and temporal scales. It also reviews the interactions of plants withbiotic and abiotic factors at individual, population, community and ecosystem levels and provides insights and solutions to common ecological/ environmental issues.

Prerequisites: none

Intended Learning Outcomes: At the end of this course the students will be able to:

- explain ecological principles and concepts that govern the distribution and abundance of organisms on earth.
- design and conduct ecological experiments and analyze and interpret data
- communicate experimental findings in both written and oral forms
- apply the knowledge to understand and mitigate current ecological issues.

Course Content: Plant as an individual: the advantage of being a population of sub unitary parts, life histories, adaptations and trade-offs between traits. Plant populations: effects of intra-specific competition. Communities: co–existence and competitive exclusion, biotic interactions and co-evolution, environmental perturbations and resilience, spatial and temporal changes in communities. Reproductive biology of angiosperms, seed production and dispersal, germination and seedling establishment, aerial and buried seed banks. Litter dynamics, energy and nutrient cycling in natural and man-modified ecosystems. Restoration of degraded and fragmented habitats, use of models in predicting changes in ecological systems.

Method/s of Evaluation: End of semester theory (70%) and practical examination and/or individual and group assignments (30%).

Recommended Reading:

- Ecology- Individuals, Populations and Communities: (Begon, M., Harper J. L., and Townsend, C. R.) 1996.
- Seeds- Biogeography and Evolution of Dormancy and Germination (Baskin, C. C. and Baskin, J. M.) 1998.
- Relevant articles and journal papers

Course Code and Title: BT 4026: General Paper in Plant Biology

Credit Value: 1 C (30 P)

Rationale: This course provides students with an opportunity to understand the interrelationships between different disciplines in plant biology and demonstrate knowledge on the same.

Pre-requisites: None

Intended Learning Outcomes: It is expected that the students will be able to;

- demonstrate understanding of the general aspects of plant biology

Course Content: Students will be examined in general aspects of plant biology acquired during their four years of study, in order to develop and enhance skills to relate different disciplines in plant biology.

Method/s of Evaluation: End of semester written examination.

Recommended Reading:

- Literature pertaining to the current topics in plant biology

Course Code and Title: BT 4027: Research Project in Plant Sciences

Credit Value: 8 C (240 P)

Rationale: This course provides students with an opportunity to improve analytical and scientific communication skills, expand knowledge, and conduct a research project relevant to Plant Sciences.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate understanding of the research topic
- experiment, collect and analyze data, generate new information, and propose solutions to a scientific question
- develop organized individual work habits and interpersonal skills
- synthesize a dissertation

Course Content: Each student will be required to carry out a guided research project on a specific topic given, under the supervision of an academic staff member and submit a dissertation.

Method/s of Evaluation: Evaluation will be based on the research and analytical skills and the dissertation presented (100%).

Recommended Reading:

- Recent scholarly articles relevant to the research topic

Course Code and Title: BT 4028: Research Project in Biotechnology

Credit Value: 8 C (240 P)

Rationale: This course provides students with an opportunity to improve analytical and scientific communication skills, expand knowledge, and conduct a research project relevant to Biotechnology.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate understanding of the research topic
- experiment, collect and analyze data, generate new information, and propose solutions to a scientific question
- develop organized individual work habits and interpersonal skills
- synthesize a dissertation

Course Content: Each student will be required to carry out a guided research project on a specific topic given, under the supervision of an academic staff member and submit a dissertation.

Method/s of Evaluation: Evaluation will be based on the research and analytical skills and the dissertation presented (100%).

Recommended Reading:

- Recent scholarly articles relevant to the research topic

Course Code and Title: BT 4030: Literature Review and Seminar I

Credit Value: 2C (60 P)

Rationale: This course aims to provide students with science communication skills. The students will acquire skills in academic writing, developing research project proposals, and making effective presentations.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- critically review the scholarly articles, identify gaps in the research area
- formulate aims and objectives, establish a research framework in relation to the research problem/topic being studied
- synthesize a literature review report
- develop a project proposal and make an effective oral presentation
- demonstrate understanding of a given research topic

Course Content: Compilation of a literature review and development of a project proposal pertaining to a given research topic and making a presentation on the same

Method/s of Evaluation: Evaluation of the written report (70%) and a seminar presentation (30%).

Recommended Reading:

- Recent scholarly articles relevant to the research topic

Course Code and Title: BT 4031: Assignment

Credit Value: 3 C (90 P)

Rationale: This course aims to provide students with skills in extracting information, critical analysis and scientific communication.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate understanding of a given topic
- collect information from various sources, analyze and compile a report
- demonstrate the ability to participate in an academic/formal discussion

Course Content: Each student will be assigned a topic having relevance to Sri Lanka. The assignment comprises identifying research and development needs, critical analysis of findings and submission of a report.

Method/s of Evaluation: Evaluation of a written report (70%) and *viva-voce* examination (30%).

Recommended Reading:

- Recent scholarly articles relevant to the assignment topic

Course Code and Title: BT 4032: Seminar II and Viva-Voce

Credit Value: 1 C (30 P)

Rationale: This course aims to provide students with effective oral communication skills.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate understanding of a given research topic
- make an effective oral presentation on the research outcomes
- demonstrate the ability to participate in an academic/ formal discussion

Course Content: Students are expected to present a seminar on the research conducted in the courses BT 4027/BT 4028/ BT 4033and defend a *viva-voce* examination.

Method/s of Evaluation: Seminar (80%) and *viva-voce* examination (20%).

Recommended Reading:

- Recent scholarly articles relevant to the research topic

Course Code and Title: BT 4033 Research Project in Bioinformatics

Credit Value: 8 C (240 P)

Rationale: This course provides students with an opportunity to improve analytical and scientific communication skills, and expand knowledge and conduct a research project relevant to Bioinformatics

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate understanding of the research topic
- experiment, collect and analyze data, generate new information, and propose solutions to a scientific question
- develop organized individual work habits and interpersonal skills
- synthesize a dissertation

Course Content: Each student will be required to carry out a guided research project on a specific topic given, under the supervision of an academic staff member and submit a dissertation.

Method/s of Evaluation: Evaluation will be based on the research and analytical skills and the dissertation presented (100%).

Recommended Reading:

- Recent scholarly articles relevant to the research topic

Course Code and Title: BT 4035: Vegetation Description and Analysis

Credit Value: 3C (15 L 60P)

Rationale: The course provides knowledge on floristic characteristics of plant communities at local, regional and global scales. It is expected to motivate learners towards field investigations of plant assemblages, develop skills and build confidence to successfully conduct a floristic survey.

Pre-requisites: BT 1114

Intended Learning Outcomes: At the end of this course the students will be able to;

- Demonstrate the understanding of the depth of description and analysis of vegetation data
- identify suitable sampling method(s) and floristic data requirements for a given study
- collect, process, analyze and interpret field data of plant communities independently
- communicate information on characteristics of vegetation in oral and written forms

Course Content: Theoretical and practical aspects of vegetation sampling techniques, description of vegetation using physiognomic characters and floristic units, construction of vegetation profiles, processing and analysis of floristic data using available software, comparison of ecological diversity among sites.

Method/s of Evaluation: End of semester written examination (40%) and assignments (60%). Assignments will be based on oral presentations on a given topic, field work, analysis of floristic data and dissemination of findings.

Recommended Reading:

- Plant Ecology (Moor, P. D. and Chapman, S. B.) 1986
- Vegetation Description Analysis- A Practical Approach: (Kent, M. and Coker, P.) 1994
- Relevant journal articles and other publications

Course Code and Title: BT 4036: Applications in Geographic Information Systems (GIS)**

Credit Value: 1 C (30 P)

Rationale: GIS is a computer based information system that facilitates input, storage, retrieval, processing, analyzing and visualizing geospatial data for land use planning. This course will introduce basic concepts and applications in the form of laboratory exercises using GIS software.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- explain how GIS is used for regional land-use planning, landscape developments, and natural resource management and related fields
- explore interdisciplinary elements of GIS
- apply knowledge and technical skills to propose solutions for issues faced by communities and industries

Course Contents: Introduction to GIS and it's definitions; data types: spatial and non-spatial databases, application of geo-spatial digital data and data models, data capturing techniques (scanning of maps, remote sensing and GPS digitizing, etc), data manipulation and validation (data adding and conversion, geo-referencing and coordinates transformation, etc.); data analysis, generation, display and presenting results and maps; GIS applications for assessing health of vegetation and land use management.

Method/s of Evaluation: Practical examination and or assignments.

Recommended Reading:

- Michael J de Smith, Michael F Goodchild, Paul A Longley (2015). Geospatial Analysis A Comprehensive Guide to Principles, Techniques and Software Tools - Fifth Edition - The Winchelsea Press, Winchelsea, UK
- Michael Schmandt **GIS Commons: An Introductory Textbook on Geographic Information Systems**, available online; giscommons.org 2017
- Articles provided by the lecturer.

Course Code and Title: BT 4105: Advanced Plant Biochemistry and Physiology**

Credit Value: 4 C (45 L 30 P)

Rationale: This course focuses on integration of biochemical and metabolic processes into plant physiology, in order to obtain an integrative overview of how plants live, function and survive. Key biochemical pathways in plants and associated regulatory mechanisms will be discussed. Advanced topics in plant physiology will be discussed with a special emphasis on adaptation processes. Signal transduction in plants will be discussed as a key process that controls plant growth and development by receiving and responding to extra/intra-cellular and environmental signals, with emphasis on molecular mechanisms of plant hormone signaling. Relevance, importance and merging applications of plant biochemistry and physiology in the areas of global climate change, human health and biotechnology will be discussed. The course also includes quantitative aspects of biochemistry (e.g. enzyme kinetics, bioenergetics etc.), and will provide skills on laboratory, experimental and analytical techniques relevant for the topics covered in the course.

Pre-requisites: BT1011, BT1009, BT2017, BT2018

Intended Learning Outcomes: At the completion of the course the students will be able to;

- demonstrate understanding (describe/ explain/ compare/ discuss/ justify/ analyze etc.) of the aspects of plant biochemistry and physiology covered in the course
- discuss/evaluate/predict how multiple plant biochemical pathways intersect and influence each other.
- integrate the knowledge into the functioning of an intact plant in a plant community or an agricultural or horticultural setting.
- interpret research papers/ current literature in the fields of plant biochemistry and physiology
- apply their knowledge and skills as the basis of further studies or relevant research, formulate hypotheses, conduct experiments, collect and analyze data, and present results in the standard format of a scientific paper

Course Content: Enzyme Kinetics: units of enzyme activity, Michaelis- Menton equation, Km values - determination and significance; Purification, isolation and immobilization of enzymes; Regulation of metabolic pathways: regulation of enzyme activity by post translational modifications, regulation of enzyme concentration, synthesis and degradation; Protein degradation mechanisms: non-selective and selective protein degradation; Signal transduction in plants: basic types of signal transduction pathways, molecular mechanisms of signaling pathways for plant hormones; Respiration: carbon flux and respiratory metabolism, plant specific enzymes of the mitochondrial electron transport chain and non-phosphorylating by-passes, cyanide insensitive respiration and its physiological significance; Pentose Phosphate Pathway and its metabolic significance; Photosynthesis (ecological and agricultural aspects and biotechnological applications): sun and shade plants, adaptive significance of C_4 plants, applications in biotechnology - C_3 to C_4 conversion for crop improvement; Carbohydrate

metabolism: triose phosphate and hexose phosphate pools, starch and sucrose synthesis and degradation; Lipid metabolism: structures and types, synthesis of triglycerides, metabolism, β-oxidation, glyoxylate cycle, gluconeogenesis; NO_3^- Assimilation: nitrate reductase (NR) as the regulatory enzyme of NO_3^- assimilatory pathway, biological nitrogen fixation; Secondary metabolism and plant natural products: primary and secondary metabolism, roles of secondary metabolites, main classes (terpenoids, phenolics and N-containing compounds) and their biosynthesis, shikimic acid pathway and its significance, role of secondary metabolites in plants, plants secondary metabolites and man; biochemical aspects of senescence and programmed cell death; Elucidation of metabolic pathways (functional genomics, proteomics, mutant analysis, etc.)

Laboratory sessions: Laboratory experiments related to above topics; group laboratory project leading to writing of a standard scientific manuscript.

Method/s of Evaluation: End of semester examinations: theory (70%) and practical/ assignments/ continuous assessments (30%)

Recommended Reading:

- Taiz, L., Zeiger, E., Møller, I. M. and Murphy, A. (2014). Plant Physiology and Development (6th Edition), Sinauer Associates, inc.
- Taiz, L. and Zeiger, E. (2010). Plant Physiology (5th Edition), Sinauer Associates, Inc.
- Buchanan, B. B., Gruissem, W. and Jones, R. L. (Eds.). (2015). Biochemistry and Molecular Biology of Plants (2nd Edition),Wiley.
- **Berg, J. M., GattoJr.,G. J., Tymoczko, J. L. and Stryer, L. (2015). Biochemistry (8th Edition), W. H. Freeman**
- **Berg, J. M., Gatto Jr., G. J., Tymoczko, J. L. and Stryer, L. (2015). Student Companion for Biochemistry (8th Edition), W. H. Freeman**
- **Jones, R. L., Ougham, H. and Waaland, S. (2012). The Molecular Life of Plants (1st Edition), Wiley-Blackwell**

Course Code and Title: BT 4107: Trends in Plant Molecular Biology**

Credit Value: 3 C (45 L)

Rationale: The course aims to provide students with newest concepts in molecular biology and their applications in research. Students will acquire in-depth knowledge and understanding of the regulation of gene expression, novel approaches used to explore molecular mechanisms underlying plant developmental processes, and gene expression analysis and interpretation.

Pre-requisites: BT 2015, BT 3003, BT 3063 and BT 3053

Intended Learning Outcomes: After successful completion of this course module, students will be able to;

- describe the components involved in the regulation of gene expression
- identify and analyse ways of regulation exerted at different levels of gene expression
- explain the regulation of gene expression in prokaryotes and eukaryotes
- describe the gene expression profiling methods
- discuss current research trends in plant molecular biology and their application
- evaluate scientific literature, formulate testable hypotheses, then suggest experiments to test the hypothesis, and produce a research proposal tailored to address a biological problem/issue using tools of molecular biology

Course Content: Regulation of gene expression: importance of differential gene expression in plant development, components involved in regulation of gene expression, regulation at initiation of transcription, regulation at the level of transcription, post transcriptional control, factors affecting the expression of a gene, specific examples of regulation of plant genes; Gene expression profiling: transcriptomics i.e. methods and applications of single cell transcriptomics in plants, high throughput sequencing, qRT-PCR, and mining and visualising functional genomic/transcriptomic/proteomic data, case study i.e. transcriptome profiling of a plant developmental process e.g. single cell transcriptome profiling of seed development; Genome editing systems: Zinc Finger nuclease, TALEN (Transcription Activator-Like Effector Nucleases), CRISPR (Clustered Regulatory Interspaced Short Palindromic Repeats)/Cas9; Writing assignment: an interactive session focusing on drafting a single page research proposal.

Method/s of Evaluation: End of semester written examination (80%) and in-class assignment (20%)

Recommended Reading:

- Buchanan B. B., Gruissem W., Jones R. L. (2015). *Biochemistry and molecular biology of plants*. Wiley Blackwell, New York, NY.
- Grierson D. (1991). *Developmental regulation of plant gene expression*. Springer Science Business Media LLC, New York.
- Reviews and recent journal articles relevant to the subject

Course Code and Title: BT 4125: Post-harvest Technology**

Credit Value: 2 C (20 L 20 P)

Rationale: The course intends to develop an appreciation for the factors related to quality deterioration and wastage of horticultural produces after harvest. The course will provide an understanding of physical, physiological, biochemical, and pathological factors that contribute to post harvest deterioration of horticultural products and, knowledge and skills on laboratory and commercial procedures of quality testing, harvesting, preparation, packaging, transportation, and storage of horticultural products to minimize post-harvest losses.

Pre-requisites: None

Intended Learning Outcomes: By the end of this course the students will be able to;

- assess different physical, physiological, biochemical, and pathological factors related to quality deterioration and wastage of horticultural produces after harvest.
- examine commercial aspects related to post harvest handling of horticultural produce in terms of distribution, marketing, food safety and quality standards.
- appraise different methods available to minimize post harvest losses and uphold quality standards
- design and implement appropriate strategies to minimize post harvest losses and maintain post harvest quality of horticultural commodities.

Course Content: Overview of post harvest handling: extent, importance of appropriate technology; Biological aspects: respiration, transpiration and water loss, ethylene, etc.; Morphological, anatomical and physiological basis of post harvest technology, physiological disorders; Post harvest diseases: types and sources of infection, factors effecting disease development; Harvesting of produce: maturity indices, pre-harvest modifiers of quality; Preparation/treatment of produce: trimming, cleaning and water elimination, curing, waxing and grading, ripening, de-greening and colour adding, precooling; Packing house preparation: purpose and function; Packaging and transport of produce: functions and types of packaging, transport conditions; Refrigerated storage; objectives, structural requirements; Supplements to refrigeration: irradiation, chemical and biological treatments, controlled and modified atmosphere; Alternatives to refrigeration: ambient storage, evaporative cooling, storage in water, air-cooled and clamp storage, solar cooling; Commercial practices: quarantine treatments, distribution and marketing, food safety and quality standards; Emerging concepts and practices.

Laboratory sessions: Laboratory experiments related to above topics will be covered.

Method/s of Evaluation: End of semester theory (70%) and practical examination and/or assignments (30%).

Recommended Reading:

- **Dris, R., Niskanen, R. and Jain, M. (2001). Crop Management and Postharvest Handling of Horticultural Products: Quality Management, Science Publishers**
- Shewfelt, R.L and Prussia, S.E. (1992). Post Harvest Handling (1st Edition) Academic Press.
- Agrios, G.N. (1997 and 2005). Plant Pathology, Academic Press
- Bautista, O.K. (1990). Post Harvest Technology for SE Asia Perishable Crops, Technical Learning Research Center, Manila, Philippines

Course Code and Title: BT 4134: Biodiversity Conservation**

Credit Value: 2 C (20 L, 20 P)

Rationale: The course provides insight into the causes of the depletion and degradation of biodiversity, and into theory and practice of conservation of species and restoration of habitats. The students will acquire in depth knowledge and skills to successfully contribute to conservation of biodiversity of Sri Lanka.

Pre-requisites: BT 1114

Intended Learning Outcomes: At the end of this course the students will be able to:

- discuss the reasons for current loss of biodiversity
- explain concepts and theory in biodiversity conservation
- appreciate the role of ethics, attitudes of human in effective conservation interventions
- analyze issues related to biodiversity conservation in Sri Lanka
- suggest potential measures to mitigate future biodiversity losses

Course Content: Components of biodiversity; Loss of species and degradation of ecosystems; Concept of sustainable development and principles of biodiversity management; Valuation of biodiversity and ecosystem services; Conservation of biodiversity with special reference to Sri Lanka: risk assessments, in-situ and ex-situ conservation practices, adaptive management and community participation, success and failures in biodiversity management.
Practical component: Practical sessions relevant to topics taught in theory will be covered

Method/s of Evaluation:
End of semester theory (60%), and practical examination or assignments (40%).

Recommended Reading:

- National Biodiversity Strategy and Action Plan-2016, Ministry of Mahaweli Development and Environment
- Reports and Articles provided by the lecturer

Course Code and Title: BT 4901 Landscape Maintenance and Management**

Credit Value: 2C (15 L 30 P)

Rationale: The course is designed to help the students to develop expertise and practical skills on implementation and management actions essential for maintenance of the main elements of transformed landscapes. It will address safety occupational hygiene aspects important to the horticulture and landscaping industry.

Pre-requisites: None

Intended Learning Outcomes: After completion of the course students should be able to;

- recognize the requirements for landscape management
- apply theoretical and practical aspects related to landscape maintenance and management

Course Content: Maintenance and management of water: water harvesting techniques and its sustainable use; Energy: thermal comfort, efficiency in energy utility and conservation; Biodiversity: advantages of using native species, controlling weeds and invasive species, impact assessments and quarantine aspects, conservation of rare threatened species; Nutrients and plant growth: fertilizers, growth regulators, training/ pruning of plants, turf and lawn care. Maintaining special landscapes: e.g. successional, wild and agricultural landscapes; green house management; Use of traditional and modern machinery, occupational safety concerns in horticulture and landscaping industry; Human resource management related concerns: work force planning, training and development, performance management

Method/s of Evaluation: End of semester examination (70%) and assignments (30%)

Recommended Reading:

- Van Der Zanden, A.M. and Cook, T.W. (2010). Sustainable Landscape Management: Design, Construction, and Maintenance, Wiley publications
- Smith, S.W. (1996). Landscape Irrigation: Design and Management. Wiley publications

Course Code and Title: BT 4902: Industrial Training**

Credit Value: 12 C

Rationale: Industrial training provides undergraduates with on the-job training and real-life job experience, making them more aware of the needs and expectations of horticulture and landscape industry as well as enhancing their employability potential. Additionally, the program can foster closer interaction between the industry and the University.

Pre-requisites: None

Intended Learning Outcomes: At the end of this course the students will be able to;

- demonstrate skills in communication, management, team work and leadership
- solve relevant industrial problems by applying theoretical and practical knowledge.

Course Content: The student is required to have a minimum of 15 weeks work experience by appropriate employment in the horticulture and landscape industry under industrial supervision. Proposal for employment must be submitted to coordinator for approval prior to starting work. Students will be required to produce documented evidence of their work experience. Student are requested to complete the logbook, provide a written report and present their work and experiences after the industrial training.
An academic mentor and a placement mentor (supervisor from the industry) will be assigned for each student.

Method/s of Evaluation: Evaluation will be done by a panel of examiners appointed by the Department for Industrial training report (50%), Presentation (30%) and Logbook (20%)

Course Code and Title: BT 4903 Seminar and Report**

Credit Value:2 C (30 L)

Rationale: This course module aims to provide training in scientific writing and academic presentation while broadening the knowledge in the field of horticulture and landscaping.

Pre-requisites: None

Intended Learning Outcomes: After successful completion of this course module, students will be able to;

- critically review scientific literature in the field, and logical organization and presentation of information
- demonstrate proficiency in scientific writing, presentation and communication skills

Course Content: Topics for the oral presentation and report will be announced during the course.

Method/s of Evaluation: End of the semester oral presentation (40%) and report submission (60%)

Recommended Reading:

- Relevant literature will be acquired by the student

Course Code and Title: BT 4908 Soil Management**

Credit Value:2 C (20 L 20 P)

Rationale: This course is designed to give a basic understanding about the physical, chemical and biological nature of soil and applying of such knowledge in managing soil for improved soil and crop health, and crop production.

Pre-requisites: None

Intended Learning Outcomes: At the end of the course the students will be able to;

- describe and assess soil physical, chemical and biological properties of agricultural importance
- manipulate soil properties to align with the soil use
- identify suitable crops, cropping systems for a particular soil type
- regulate management practices for improved soil health
- plan and conduct soil sampling in accordance with the requirement

Course Content: Introduction to soil: physical, chemical and biological properties of soil; Soil management practices: soil amendments, irrigation, tillage, salinity, soil pest, disease and nutrient management, biological diversity; Soil erosion and erosion control; monitoring soil performance: Soil sampling and testing; managing crop diversity for improved soil health

Practical component to understand soil properties and perform soil tests for nutrient management

Method/s of evaluation: End of semester theory and practical examination (80%); Assignments (20%)

Recommended Reading:

- Brady, N.C. and Weil, R.R. (1996). The Nature and Properties of Soil, Pearson
- Barthakur, H.P. and Baruah, T.C. (1999). A Textbook of Soil Analysis, Sangam Books Ltd.
- Tan, K.H. (2010). Principles of Soil Chemistry (4th Edition), Sangam Books Ltd.
- Sarkar, D. and Haldar, A. (2010). Physical and Chemical Methods in Soil Analysis (2nd Edition),New Age International Pvt. Ltd Publishers

** Detail syllabi approved by the CDEC (in the form of new format)