

PRINCIPAL SUBJECT AREA

BOTANY

400 LEVEL COURSES

BT 401 Nitrogen Fixation (3 credits)

Nitrogen fixation (abiological and biological), the global cycle, importance and relevance to national development. Organisms and systems that fix nitrogen, free-living, symbiotic, associative and endophytic. Methods of measuring nitrogen fixation based on, Kjeldahl analysis, acetylene reduction assay, isotopes (radioactive and heavy ¹⁵N), direct labelling and substrate labelling techniques. Gas chromatography, Mass Spectrometry and Emission Spectrometry. Enzymology of nitrogen fixation, the enzyme system, factors affecting the enzyme, oxygen sensitivity and mechanisms to protect the enzyme from oxygen inhibition. Requirements for nitrogen fixation and how these are met in nature. Biochemistry of nitrogen fixation including the mechanism. Genetics of nitrogen fixation, Nif genes and their regulation. Application of nitrogen fixation in agriculture and forestry.

Practical exercises based on above topics.

Recommended Texts:

1. Gallon, J. R. and Chaplin, A. E. (1987). *An Introduction to nitrogen fixation*. Cassell Education limited.
2. Alexander, M. (1984). *Biological nitrogen fixation - Ecology, technology and physiology*. Plenum publishing corporation.
3. Ladha, J. K., George, T. & Bohlool, B.B. (Eds.) (1992). *Biological nitrogen fixation for sustainable agriculture*. Kluwer Academic Publishers.
4. Khush, G. S. & Bennett, J. (1992). *Nodulation and nitrogen fixation in rice*. International Rice Research Institute, Philippines.

BT 402 Rhizobiology (3 credits)

(Prerequisite: BT 302)

Introduction to the family Leguminosae & the nodule forming bacterium. *Rhizobium* characteristics. Counting *Rhizobium* in soil. Ecology of *Rhizobium*, rhizosphere of legumes. Abiotic and biotic factors affecting rhizobial growth in soil, numbers and distribution in soil, artificial introduction of *Rhizobium* into soil. Species relationships and cross inoculation groups. Effective and ineffective nodulation. Census of nitrogen fixers. Study of infection, nodulation.

Practical exercises based on above topics.

Recommended Texts:

1. The Biology of Nitrogen Fixation. Ed: A. Quispel. *Botanical Laboratory*, State University Leyden, The Netherlands (1974), North Holland Publishing Company, Amsterdam, Oxford American Elsevier Publishing Company, Inc. New York.
2. Vincent J. M. (1970) *A manual for the practical study of root-nodule bacteria*. Blackwell scientific Publications, Oxford and Edinburgh (I B P Handbook No. 15)
3. Somasegaran, P. & Hoben, H.J (1994). *Handbook for rhizobia*. Springer-Verlag, New York.

BT 403 Plant Toxicology (2 credits)

(Prerequisite: BT 207)

Introduction to terminology used in toxicology – LD 50, bioaccumulation, biodegradability, dose – response relationships, microbial toxins – of bacteria, cyanobacteria and fungi (mushroom toxins and mycotoxins), their nature and effects, factors contributing to their formation in food and methods of prevention of contamination and decontamination; case studies, toxins of higher plants, their nature and effects, analytical techniques, legislature in different countries, uses of toxins.

Practical exercises based on above topics.

Recommended Texts:

1. Eaton, D.L. Groopman, J. D. (1994). *The toxicology of aflatoxins*. Academic Press, U.K.
2. Friedman, M. (1990). *Nutritional and Toxicological consequences of food processing. Advances in Experimental Medicine and Biology*. Vol 289. Plenum Press.
3. Jones, J. M. (1993). *Food Safety*. Eagon Press.
4. Miller, J. D. Trenholm, H. L. (1994). *Mycotoxins in grain – compounds other than aflatoxins*. Eagon Press.
5. Vries, D. J. (1997). *Food Safety and Toxicology*. CRC Press, USA.

BT 404 Advanced Plant Pathology (2 credits)

(Prerequisite: BT 304)

Plant-pathogen interactions, mechanism of pathogen attack, natural disease resistance in plants, induced resistance and Systemic Acquired Resistance. Plant disease diagnosis. Conventional and modern plant disease control methods, Plant Quarantine, Integrated Pest Management (IPM). Independent study and seminar. Practical exercises based on above topics.

Recommended Texts:

1. G.N. Agrios (1997). *Plant Pathology*, 4th Edition, Academic Press, U.K.
2. Abeygunawardena, D.V.W. (1969). *Diseases of cultivated plants, Their diagnosis and treatment in Ceylon*, The Colombo Apothecaries Co. Ltd., Sri Lanka.
3. Fox, R.T.V. (1992). *Principles of diagnostic techniques in plant pathology*, CAB International.
4. Bailey, J.A. & M.J. Jeger (1992). *Colletotrichum: Biology, Pathology & Control*, CAB International.

BT 405 Plant Biochemistry II (3 Credits)

(Prerequisite: BT 207)

Carbohydrates in plants, chemical classification, classification according to function, nutritional classification of starch, role of carbohydrates in the food industry, food starch modifications; physical and chemical modifications, non-food uses of starch. Proteins and amino acids in plants, types of amino acids and their classification, functional properties of proteins, role of plant proteins in human nutrition, sources of plant proteins and their importance in developing countries, anti-nutritional factors associated with cereal and legume proteins, improving the quality of proteins and the uses of plant proteins in other industries.

Lipids: classification and chemistry of lipids, catabolism of lipids in plants, biological functions, role in human nutrition, oxidation and rancidity reactions in food, plant pigments and related secondary metabolites, classification, functions other than pigmentation, related biosynthetic pathways. Practical exercises based on above topics.

Recommended Texts:

1. Meuser, F. Manners, D. J. & Siebel, W. (Eds.) (1993). *Plant polymeric carbohydrates*. The Royal Society of Chemistry, Cambridge, U.K.
2. Weil, J. H. (1990). *General Biochemistry* (6th Edition). Wiley Eastern Limited, New Delhi, India.
3. Lehninger, A. L. (1986). *Principles of Biochemistry*. Worth Publishers, Inc., New York, USA.
4. Salisbury, F. B. & Ross, C. W. (1992). *Plant Physiology*. Wadsworth Inc., USA
5. Taiz, L & Zeiger, E. (1991). *Plant Physiology*. The Benjamin / Cummings Publishing Company, 546.

BT 406 Plant Molecular Genetics and Biotechnology (3 credits)

(Prerequisite: BT 307)

Structure, regulation and expression of plant genes; gene cloning. Screening methods and isolation of recombinant clones, plasmid and other vector systems; construction of genomic and cDNA libraries; DNA sequencing & DNA synthesis. Manipulation and transforming genes. Enzymes in cloning. Recombinant DNA technology and its application. Bioinformatics and integrative genomics: Web based search for biological information and literature. Analyses of biological data and interpretation. Proteomics: protein structure and function, proteomic analysis, protein separation and identification, 2D gel electrophoresis (IEF & SDS-PAGE), immunoblotting, MALDI-TOF Mass Spectrometry. Nutrigenomics (Nutritional Genomics): connection between human genetic diversity and nutrition.

Practical exercises based on above topics.

Recommended Texts:

1. Old, R.W. and S.B. Primrose (1994). *Principles of gene manipulation: An introduction to genetic engineering*. (5th Edition), Blackwell Science Ltd, Australia.
2. Lodish, H. *et al.*, (1995). *Molecular cell biology*, 3rd Edition, Scientific American Books Inc., New York, USA.
3. Walker, J.M. and E.B. Gingold (1993). *Molecular biology and biotechnology* (3rd Edition), The Royal Society of Chemistry, U.K.
4. Watson, J.D. *et al.*, (1992). *Recombinant DNA*. 2nd Edition. Scientific American Books, New York.
5. Brown, T.A. (1998). *Genetics: A molecular approach* (3rd Edition), Stanley Thornes (Publishers) Ltd.
6. Attwood, T.K. and D.J. Parry-Smith (1999). *Introduction to bioinformatics*, Longman, England.
7. www.ncbi.nlm.nih.gov
8. www.tigr.org
9. www.ebi.ac.uk

BT 407 Advanced Plant Systematics (2 credits)

(Prerequisite: BT 308)

Different types of data: morphological, anatomical, phytochemical, palynological and molecular data. Phylogenetic systematics, constructing classification systems. Angiosperm classification based on molecular data. Role of plant systematics in biodiversity conservation and management. Role of Molecular data in biodiversity conservation management. Selected plant orders and families.

Practical exercises based on above topics.

Recommended Texts

1. Ray, P.M. and Harborne, J.B. (Eds) (1999). *Plant Biochemistry*. Academic Press, San Diego.
2. Judd, W. S., Campbell, C.S., Kellogg, E.A., and Stevens, P.F. (1999). *Plant Systematics: A phylogenetic approach*. Sinauer Associates, Inc., Sunderland, Massachusetts, U.S.A.

BT 408 Advanced Plant Physiology (2 credits)

(Prerequisites: BT 206, BT 207)

Architecture of plant cell walls. Root development, cellular organization and function, functions of root tissues in nutrient and water transport, factors affecting the distribution of roots, exudation and symbiotic associations, effects of the physical environment on the development and growth of roots. Competition between root systems. Physiological and morphological plasticity of the roots and the use of ³²P in root uptake studies. Physiological considerations of photosynthesis and water relations, photosynthetic responses of leaves to CO₂ and light, hydraulic architecture of plants, carbon isotope discrimination and plant Water-use-efficiency, eco-physiological adaptations of plants to drought. Plant secondary metabolites.

Practical exercises based on above topics.

Recommended Texts:

1. Lambers, H., Stuart, F., Chapin, I. & Thijs, L.P. (1998). *Plant Physiological Ecology*. Springer-Verlag.
2. Taiz, L. & Zeiger, E. (1999). *Plant Physiology*. Benjamin Cummings Publishing Company, New York, USA.
3. Hopkins WG (1999). *Introduction to Plant Physiology*. John Wiley and Sons, New York, USA.
4. Hall, D.D. & Rao, K.K. (1999). *Photosynthesis* (6th Edition). *Studies in Biology Book Series*. Cambridge University Press, U.K.

BT 409 Dynamic Plant Ecology (3 credits)

(Prerequisites: BT 309, BT 310)

Natural ecosystems of Sri Lanka (extension lectures). Ecosystem dynamics (fire ecology, phenology, nutrient cycling, population dynamics, competition). Sustainable utilization of goods and services (including nature tourism). Dendrology, plant-animal interactions. Analysis and interpretation of quantitative ecological data. International conventions and national strategies in relation to conservation and sustainable management of plant diversity.

Recommended Texts:

1. Crawley, M. J. (ed.) (1997). *Plant Ecology* (2nd Edition), Blackwell Science Ltd., USA, 715pp.
2. Magurran, A. E. (1988). *Ecological Diversity and Its Measurement*. Croom, Helm, Australia, 179pp.
3. Kent, M. and Coker, P. (1996). *Vegetation Description and Analyses: A Practical Approach*. John Wiley and Sons, 363pp.
4. Begon, M., Harper, J. L. and Townsend, C. R. (1990). *Ecology: Individuals, Populations and Communities*. Blackwell Scientific Publications, USA, 945pp.
5. Primack, R.B. (2000). *A primer of Conservation Biology*. Sinauer Associates, Inc. Publishers, USA, 319pp.

BT 410 Forestry (2 credits)

Natural forests, plantation forests and agro-forestry systems, local and global demands for forest products, forest measurements, nursery practice, seed and forest genetics, factors of the forest site. Silvicultural characteristics and species choice, establishing plantations and special tree crops. After-care of plantations, silvicultural systems. Thinning, harvesting, marketing; sustainable forest management. Forests and forest policy in Sri Lanka.

Recommended Texts:

1. Julian Evans (1992). *Plantation Forestry in the Tropics*. Clarendon Press, Oxford. U.K., 472pp.
2. Raymond A. Young and Ronald L. Giese.(1990). *Introduction to forest science*. 2nd edition. John Wiley and Sons, New York, 575pp.
3. Savill, P.S. and Julian, E. (1986). *Plantation silviculture in temperate regions with special references to the British Isles*. Clarendon press.Oxford, U.K. 235pp.
4. Hart, C. (1991). *Practical forestry for the agent and surveyor*. 3rd Edition. Alan Sutton publishing Ltd, U.K. – 642pp.
5. Philip, M.S. (1994). *Measuring trees and forests*. 2nd Edition. CAB International, Wallingford, U.K., 264pp.

BT 411 Herbarium (1 credit)

Students will collect a recommended number of specimens representing lower and higher plants, identify and submit as herbarium specimens.

BT 412 Applied Microbiology (2 credits)

(Prerequisite: BT 302)

Microorganisms with industrial and environmental use and their products. Growth and product formation in industrial processes, large scale fermentations: food, alcoholic beverages, animal feed, single cell proteins, antibiotics, organic acids, amino acids, enzymes, vitamins. Fuel and energy. Waste water treatment and utilization. Setting up a microbiological laboratory. Selected titles from the above course content will be offered each year.

Recommended Texts:

1. Atlas, R.M. (1995). *Principles of Microbiology*. Mosby.
2. Glazer, A.N. and Nikaido, H. (1995). *Microbial biotechnology. Fundamentals of Applied Microbiology*. W.H. Freeman & Company, New York, USA.
3. Madigan, M.T., Martinko, J.M. and Parker. J. (2002). *Brock Biology of Microorganisms*. 10th Edition. Prentice Hall, USA.

BT 413 Advanced Plant Developmental Physiology (2 credits)

(Prerequisite: BT 305)

Classification of natural and synthetic plant growth regulators (PGRs), biosynthetic pathways, transport and catabolism of natural PGRs, molecular basis of action, cell signaling pathways, regulation of hormone levels in plants, role of PGRs in crop production and postharvest technology, effect of PGRs on human health, production of PGRs by microorganisms.

Recommended Texts:

1. Fosket, D.E. (1994). *Plant Growth and Development- A Molecular Approach*. Academic Press, Inc., New York.
2. Howell, H.S. (1998). *Molecular genetics of plant development*. Cambridge University Press, U.K.
3. Moore, T.C. (1974). *Research Experiences in Plant Physiology - A Laboratory Manual*. Springer-Verlag, New York, USA.
4. Srivastava, L.M. (2002). *Plant Growth and Development – Hormones and Environment*. Academic Press, U.K.
5. Taiz, L., Zeiger, E. (1999). *Plant Physiology*. Benjamin Cummings Publishing Company, New York, USA.
6. Hopkins, W.G. (1999). *Introduction to Plant Physiology*. John Wiley & Sons, Inc.

BT 414 Independent study (1 credit)

A structured programme to encourage active student learning and develop their communication and presentation skills. The students obtain an in-depth understanding of given topics of botanical interest by literature survey and reading recommended research/scientific articles and deliver seminar/s.

BT 415 Research Project (6 credits)

(Prerequisite: BT 209)

Each student will carry out a research project during the final year under the supervision of a staff member. The student is required to deliver two seminars, (a) pre-project seminar, based on preparatory work and research plan and (b) end of the project seminar, based on the outcome of research and prepare a comprehensive report containing Title page, Abstract, Introduction and Literature Review, Objectives, Materials & Methods, Results, Discussion and References.