

PRINCIPAL SUBJECT AREA

MOLECULAR BIOLOGY AND BIOTECHNOLOGY

300 LEVEL COURSES

MB 301 Biochemistry and Molecular Biology Laboratory (2 credits)

(Prerequisites: MB 201, MB 226)

UV-visible spectroscopy; chromatographic methods; electrophoresis; DNA and RNA purification and analysis; polymerase chain reaction; restriction fragment length polymorphism (RFLP) and random amplified polymorphic DNA (RAPD) techniques; DNA sequencing; southern and northern transfer techniques; immunochemical methods; radioactive and non radioactive detection methods; biosensors.

Recommended Texts:

1. J. Sambrook, E. F. Fritsch and T. Maniatis (1989) *Molecular Cloning – A Laboratory Manual*, Cold Spring Harbor Laboratory Press.
2. Alexander J. Ninfa, David Ballou (1998) *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*. Fitzgerald Science Press, Inc.
3. Ed Harlow, David Lane (1988) *Antibodies: A Laboratory Manual* Cold Spring Harbor Laboratory.

MB 306 Recombinant DNA Technology (3 credits)

(Prerequisites: MB 201, MB 226)

Introduction to Recombinant DNA technology; purification and manipulation of DNA; cloning vectors; transformation; production of gene libraries; isolation, identification & characterization of cloned genes; gene expression; restriction mapping; generation of transgenic plants and animals.

Recommended Texts:

1. J. Sambrook, E. F. Fritsch and T. Maniatis (1989) *Molecular Cloning – A Laboratory Manual*, Cold Spring Harbor Laboratory Press.
2. Frederick M. Ausubel et al. (2001) *Current Protocols in Molecular Biology*, John Wiley & Sons, Inc.

MB 311 Molecular Cell Biology (3 credits)

(Prerequisite: MB 201)

Structure of eukaryotic and prokaryotic cells; cell organelles and functions; cell membrane, function and transport cross membranes; protein trafficking; organelle biogenesis; cytoskeleton and cell motility; extracellular matrix and cell adhesion; cell-to cell signaling; signaling in the sensory system; cell cycle, regulation and apoptosis.

Recommended Texts:

1. Harvey Lodish, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell (1999) *Molecular Cell Biology* W.H. Freeman & Company.

MB 316 Molecular Immunology (2 credits)

(Prerequisite: BL 101)

The immune system; structure and function of immunoglobulins; cells of lymphoid systems; response to antigenic stimulation; antigenic determinants; antigen processing and presentation; intercellular interactions; complement system and its function; biology of the major histocompatibility complex; mechanisms of immunity and hypersensitivity; immunomodulatory products of parasites; diagnostic assays using antibodies; polyclonal and monoclonal antibodies; phage antibody production; immunochemical methods.

Recommended Texts:

1. Janeway, C. (1999) *Immunobiology: The Immune System in Health and Disease*, Harcourt Health Science group
2. Roitt, I. (2001) *Essential Immunology*, Blackwell Science.
3. Abul K. Abbas, Andrew H. Lichtman (2003) *Cellular and Molecular Immunology* W.B. Saunders Company.
4. Ed Harlow, David Lane (1988) *Antibodies: A Laboratory Manual* Cold Spring Harbor Laboratory.

MB 321 Biotechnology I (2 credits)

(Prerequisites: MB 226, MB 306)

Genetic engineering of plant and animals, and their applications; biocontrol of pests; recombinant microorganisms/fermentation technology; preparation of bioactive compounds in microbes and tissue/cell cultures; biological nitrogen fixation; germplasm conservation; molecular breeding; biofertilizers; genomics and proteomics; DNA/ protein based techniques in forensic science and medicine; biodiversity and biotechnology; biosafety in biotechnology; international conventions related to biotechnology and products of biotechnology; impacts of Biotechnology on the developing world.

Recommended Texts:

1. Brown, T. A. (1990) *Gene Cloning: An Introduction*.
2. Walker, J. M., Gingold, E. B. (1993) *Molecular Biology & Biotechnology*, Royal Society of Chemistry.
3. Old, R. W., Primrose, S. B. (1994) *Principles of Gene Manipulation*, Blackwell Science.
4. Glick, B. R., Pasternak, J. J. (1998) *Molecular Biotechnology*, American Society for Microbiology

MB 326 Bioinformatics (3 credits)

(Prerequisite: MB226)

Molecular databases; bioinformatics and computational biology software; sequence alignment; phylogenetic analysis; functional genomics; DNA micro arrays; protein structure analysis, motif identification, evolutionary alignments and structure prediction; drug design

Recommended Texts:

1. Baxevanis, A. (1998) *Bioinformatics: a practical guide to analysis of genes and proteins*, John Wiley.
2. Bishop, M. (1994) *Guide to human genome computing*, Academic Press.

BT 302 Advanced Microbiology (2 credits)

Population counts, growth cycle of microorganisms. Applied microbiology. Microorganisms in their natural habitats and major activities, microbiology of air (types, diseases transmitted), soil (types, estimation, distribution, role in nutrient cycling), water (types, water pollution, coliform bacteria, sanitary water analysis, water borne diseases, water purification) and food (food microflora, food spoilage, food preservation and food borne diseases). Laboratory exercises based on above topics.

Recommended Texts:

1. Brock, T.D. , Madigan, M.T., Martinko, J.M. and Parker, J. *Biology of Microorganisms* (8th edition), Prentice Hall, USA, 986 pp.
2. Madigan, M.T. Martinko, J.M. Parker . J. Prentice Hall, USA, 986 pp.
3. Giller, K. E. and Wilson, K. F. (1991). *Nitrogen fixation in tropical cropping systems*. CAB. International, UK.
4. McLaren, R. G. and Cameron, K. C. (1996). *Soil Science: Sustainable production and environmental protection*. Oxford University Press, UK.
5. Brady, N. C. (1990). *The nature and properties of soils* (10th edition). Macmillan Publishing Company, UK.

BT 304 Plant Pathology (2 credits)

Introduction, history of Plant Pathology, terminology & definitions, cause of plant disease, infection process, mechanism of symptom development, fungal pathogenesis, plant defense responses – constitutive and inducible defenses, Systemic Acquired Resistance (SAR), principles of plant disease control, diagnosis of plant disease.

Practical exercises: Laboratory examination of diseased specimens covering major field and post-harvest diseases of food, ornamental and plantation crops, plant pathology techniques, study of plant-pathogen interactions.

Recommended Texts:

1. Agrios, G. N. (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. Mehrotra, R.S. (1994). *Plant Pathology*, 10th Print, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
4. Persley, Denis M. (1982). *Diseases of vegetable crops*. Department of Primary Industries, Queensland, Brisbane.
5. Beattie, B.B., W.B. McGlasson (1995). *Postharvest diseases of horticultural produce*, Volume 2: Tropical fruit. Department of Primary Industries, Queensland, Brisbane.

BT 309 Biodiversity Conservation & Management (2 credits)

Biodiversity – Introduction, Global biodiversity estimates, Measuring Biodiversity, Loss of biodiversity, Threats to Biodiversity, Biodiversity Conservation and Sustainable Development, Setting Conservation principles, Species management, Habitat management, Conservation Education & Ecotourism. Indigenous knowledge and Biodiversity, International conventions on Biodiversity.
Field visits.

Recommended Texts:

1. Groombridge, B. (1992). *Global Biodiversity: status of the Earth's living Resources*. Chapman and Hall. London.
2. Watson, R.T. & Heywood, V.H. (1995). *Global Biodiversity Assessment*. UNEP.

BT 311 Plant Reproductive Biology and Plant Breeding (2 credits)

(Prerequisite: BT 307)

Genetic variation and its estimation, incompatibility and its inheritance. Pollination biology. Plant breeding perspectives, plant reproductive systems, principles of plant breeding, genetic basis of plant breeding, polygenic inheritance, methods of breeding and experimental designs, quantitative inheritance, polyploidy, methods of breeding of self- and cross pollinated crops. Application of molecular marker technologies for genome analysis. Germplasm resources preservation and utilization, hybrid crops, seed production and maintenance. Field visits to Plant Genetic Resource Centre (PGRC) and Rice Research and Development Institute, Batalagoda.

Recommended Texts:

1. Poehlman, J. M. and Sleper, D. A. (1995). *Breeding Field Crops* 4th Edition, ISU Press.
2. Agarwal, R. L. *Fundamentals of Plant Breeding and Hybrid Seed Production*. Oxford and IBH Publishing Co.
3. Sharma, J. R. (1994). *Principles and Practice of Plant Breeding*. Tata Mc Graw – Hill Publishing Company Ltd., New Delhi.

CH 341 Analytical Chemistry (3 credits)

(Prerequisite: CH 231)

Advanced Calculations (12 L): Review of statistics in chemical analysis: test of significance, paired t-test, F-test, etc.; Statistics of linear chemical relationships; Performance characteristics of analytical methods; Interlaboratory testing; Sensor characteristics; Advanced calculations as applied to chemical analysis: derivation and error calculations associated with acid-base, redox and complexometric titrations; Iteration methods; metal-complex equilibria; Solubility equilibria and Gran plots.

Analytical Aspects of Spectrophotometry (9 L): Atomic absorption and emission methods, molecular uv and visible absorption spectroscopy.

Electroanalytical Chemistry (12 L): Potentiometric applications; voltammetry including polarographic methods, pulsed techniques, steady-state and flow injection amperometric methods, bulk electrolysis methods, microelectrodes in chemical analysis, electrochemical sensors,

Separation Methods (12 L): Solvent extraction, partition coefficient, distribution ratio, multiple extractions, extraction of metals, introduction to chromatographic techniques and classifications, gas chromatography, van-Deemter equation, ion-exchange chromatography, thin layer and paper chromatography, introduction to liquid-liquid chromatography.

Recommended Texts:

1. DA Skoog, West and Holler, *Analytical Chemistry*; P Kissinger and WR Heineman (1984) *Laboratory Techniques in Electroanalytical Chemistry*, Marcel Dekker; AJ Bard and L Faulkner (1980), *Electrochemical Methods*.

CH 361 Environmental Chemistry (3 credits)

(Prerequisites: CH 211, CH 221)

Theory Component (20 L): Chemical cycles, aquatic chemistry, water pollution, water treatment, water quality standards. Atmospheric chemistry, particles in the atmosphere Air pollution- inorganic and organic air pollutants, particles in the atmosphere, photochemical smog, global warming, acid rain, depletion of the ozone layer. Municipal and solid waste and their management, hazardous waste, waste as a resource; Pollution prevention and control, clean production mechanism; Environmental biochemistry; Toxicology; Environmental monitoring and analysis, sampling, classical methods and instrumentation; Analysis of data.

Laboratory Component (20 hr): Analysis of water and wastewater, analysis of air pollutants and particles; detection of pesticides.

Recommended Texts

1. SE Manahan, (1994) *Environmental Chemistry*, Lewis publishers; C Baird (2000), *Environmental Chemistry*

ZL 302 Comparative Anatomy and Animal Physiology (2 credits)

Anatomy and Physiology of Digestion, and Nutrition; Excretion and Homeostasis; Respiration and Gas exchange; Circulation and Blood; Reproduction and hormones; their Action and Regulation; Muscular system and Movement; Nervous system, Sense organs and Coordination
Practicals based on above.

Recommended Texts:

1. *Concepts of Human Anatomy and Physiology*. K.M. De Graff & I.S. Fox.
2. *Atlas and Dissection Guide for Comparative Anatomy*. S. Wischnitzer.
3. *Animal Physiology: Mechanisms and Adaptations*. R. Eckert, D. Randall & G. Augustine.
4. *Animal Physiology: Adaptation and Environment*. K. Schmidt-Nielsen.
5. *Biology*. N.K. Wessels & J.L.H. Hopson.

ZL 303 General Entomology (2 credits)

Insect Structure and Function; Classification and Identification of insects, Methods of Collecting, Preserving and Curating different insect orders; Insect development and Role of hormones; Insects of Agricultural, Medical and Veterinary importance; Principles and Methods of Insect Pest Control.
Practicals and Field work based on above.

Recommended Texts:

1. *A General Textbook of Entomology*. O.W. Richards & R.G. Davies.
2. *An Introduction to the Study of Insects*. D.J. Borror, C.A. Tiplehorn & N.F. Johnson.

ZL 312 Developmental Biology (2 credits)

(Prerequisite: ZL 201)

Introduction to Developmental Biology; Differentiation and morphogenesis in *Dictyostelium*; The cellular basis of morphogenesis; Organizing multicellular embryo; Genomic constancy; Cytoplasmic determinants; Differential gene expression during development; Maternal and zygotic control of gene expression; Maternal specification of embryonic axes; Hox genes and establishment of body plan; Cell-cell interactions; Cell signalling; Cell adhesion; Programmed cell death; Pattern formation; Establishment of segments, hierarchy of segments and segment identity of *Drosophila*; Sex determination and differentiation; Life cycles and development patterns; Aging and senescence; Regeneration; Teratogenesis; Cloning and transgenic animals.
Practical based on above.

Recommended Texts:

1. *Developmental Biology*. S.F. Gilbert.
2. *Principles of Development*. L. Wolpert, et al.
3. *Evolutionary Developmental Biology*. B.K. Hall.