PRINCIPAL SUBJECT AREA

MOLECULAR BIOLOGY AND BIOTECHNOLOGY

200 LEVEL COURSES

MB 201 Biological Chemistry (3 credits)
(Prerequisites: BL 101, CH 101, CH102)
The cell as a basic unit of life; major intracellular organelles and their functions; structure, function and metabolism of biomolecules (carbohydrates, lipids, nucleic acids and proteins) in plant and animal cells; membrane and transport; protein trafficking and organelle biogenesis; bioenergetics; cell-cell communication; moving signals across membranes; types of signals and receptors; second messengers; G-Proteins and other membrane associated signal transmitters.

Recommended Texts:
1. L. Stryer (1995) *Biochemistry*, W. H. Freeman & Co.
2. R. K. Murray, D. K. Granner, P. A. Mayes and V. W. Rodwell (1996) *Harpers Biochemistry*, Appleton and Lange.
3. David L. Nelson, Michael M. Cox (2000) *Lehninger Principles of Biochemistry* (third edition), Worth Publishers, Inc.
4. Harvey Lodish, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell (1999) *Molecular Cell Biology* W.H. Freeman & Company.

MB 206 Principles of Genetics (3 credits)
(Prerequisite: BL 101)
Mendalian genetics; alterations of Mendal laws; linkage; sex determination; cytoplasmic inheritance; cytogenetics; macro and micro mutations; polyploidy and aneuploidy; population genetics; quantitative genetics; heterosis and hybrid vigor; principles and practical aspects of breeding.

Recommended Texts:
1. Strickberger, M. W. (1999) *Evolution* (second edition), Jones and Bartlett Publishers.
2. Robert F. Weaver (2002) *Molecular Biology* McGraw-Hill.

MB 211 Cell and Tissue culture (2 credits)
(Prerequisite: BL 101)
Introduction and general techniques in cell and tissue (plants and animals) culture; preparation of culture media; isolation and culture of animal cells and tissues for assays; cell counting techniques; embryo and meristem cultures; somatic embryogenesis; protoplast isolation and culture. somatic hybridization; applications of cell and tissue culture.

Recommended Texts:
1. O. L. Gamborg and G. C. Phillips (1995) *Plant Cell, Tissue and Organ Culture*, Springer-Verlag, Gmbh.
2. M. K. Razda (2003) *Introduction to Plant Tissue Culture* (2nd edition) Science Publishers, Inc.

MB 216 General Microbiology (1 credit)
(Prerequisite: BL 101)
Introduction to microorganisms (bacteria, viruses, fungi); classification and morphology; microbial genetics; growth and metabolism of bacteria; microbial techniques (culture media, aseptic techniques, isolation and culture of bacteria, enumeration, staining, identification).

Recommended Texts:
1. Lim, D. (1998) Microbiology (Second Edition) WCB/McGraw-Hill.
2. Madigan, M. T., Martinko, J. M., Parker, J. (1997) *Biology of Microorganisms* (eighth edition), Prentice Hall.

MB 221 Enzymology (2 credits)
(Same as BT 204)
(Prerequisites: BL 101,)
Enzymes as catalysts in biological systems; protein structure and folding; classification and nomenclature of enzymes; mechanism of enzyme action; kinetics of enzymatic reactions; quantitative and qualitative aspects of enzyme activity; effect of temperature, pH, substrate, enzyme concentration and inhibitors on enzyme activity; mode of enzyme regulation; qualitative tests for different types of enzymes; isozymes and isozyme analysis; enzyme assay methods; purification and characterization and characterization; application of enzyme technology in industry; protein engineering.

Recommended Texts:
1. Robert K. Scope (1993) *Protein Purification: Principles and Practice* (third edition) Springer Verlag
2. Alan Fersht (1998) *Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding* (third edition) W H Freeman & Co.
3. David L. Nelson, Michael M. Cox (2000) *Lehninger Principles of Biochemistry* (third edition), Worth Publishers, Inc.

MB 226 Molecular Genetics (3 credits)
(Prerequisites: BL 101, CH 101, CH 102)
Organization of prokaryotic and eukaryotic genomes; genes and chromosomes; mitochondrial and chloroplast DNA; mobile genetic elements; genome replication; genetic recombination; DNA repair; RNA synthesis, processing and metabolism; the genetic code; protein synthesis; regulation of gene expression; DNA cloning and microarrays; genetic disorders and gene therapy.

Recommended Texts:
1. David L. Nelson, Michael M. Cox (2000) *Lehninger Principles of Biochemistry* (third edition), Worth Publishers, Inc.
2. Robert F. Weaver (2005) *Molecular Biology* (third edition) McGraw-Hill.

BT 201 Plant Diversity I (2 credits)
Basic concepts of biodiversity, levels (species, genetic, ecosystem); range of diversity in relation to size, life span, form, nutrition, reproduction, habitats, life cycles etc. Nomenclature and classification, importance of biodiversity, its conservation and sustainable utilization. Diversity among lower organisms: Monera (Prokaryota), Protista, algae, Chromista, Fungi. Basic characters, modern classification systems, range of form, reproduction and life cycles with reference to type examples. Importance of fungi in nature, biodeterioration, medicine, agriculture & industry.
Laboratory exercises based on above topics.

Recommended Texts:
1. Pandy, B. P. (1994). *A Text Book of Botany*, Fungi. S. Chand & Co. Ltd., New Delhi.
2. Mehrotra, K.R & Anjela, K.R. (1990). *An Introduction to Mycology*. Wiley Eastern Ltd., New Delhi.

BT 206 Plant Physiology (2 credits)
Functions of water in plant, concept of water potential and its measurements, water balance of the plant. Overview of soil-plant-atmospheric continuum, active and passive absorption of water. Stomatal physiology, solute transport in apoplast and symplast, passive and active transport of solutes across membrane barrier, essential nutrients in plants, nutrient solutions and deficiencies. Laboratory exercises based on above topics.

Recommended Texts:
1. Taiz, L & Zeiger E (1999*). Plant Physiology.* Benjemin Cummings Publishing Company, New York.
2. Hopkins, W.G. (1999). *Introduction to Plant Physiology*. John Wiley and Sons, New York.
3. Salisbury, F.B. & Ross, C.W. (1996*). Plant Physiology.* Wadsworth Publishers, London.
4. Kramer, P.J. & Boyer, J.S. (1996). *Water Relations of Plants and Soils.* Academic Press, London
5. Marschner, H. (1995). *Mineral Nutrition of Higher Plants*. Academic Press, London.

CH 221 Organic Chemistry I (2 credits)
(Prerequisites: CH 101, CH 102)
Organic Reaction Mechanisms I (15 L): Energetics – thermodynamics and kinetics of organic reactions; Concerted reactions, multi-step reactions; S_N1 and S_N2 reactions, effect of solvents, protic, polar aprotic solvents etc, neighbouring group participation, Internal S_N2; Elimination reactions E1, E2; Electrophilic and nucleophilic addition to double bonds; Electrophilic aromatic substitution; Nucleophilic aromatic substitution
Spectroscopy I (15 L): 1H-NMR and 13C-NMR spectroscopy; one dimensional and two dimensional NMR
Mass spectrometry EI-MS, CI-MS

Recommended Texts:

1. RT Morrison and RN Boyd (1998) *Organic Chemistry*, Prentice Hall; RJ Fessenden and JS Fessenden (1990) *Organic Chemistry*, Brooks/Cole Publishing Co; S. Ege (1994) *Organic Chemistry*, DC Heath & Co; GP Wannigama (2000) *Organic Reaction Mechanisms*, SEU, University of Peradeniya; TW Graham Solomon, CB Fryhle (2002) *Organic Chemistry*, John Willey; RM Silverstein, GC Bassler and TC Morrill (1991) *Spectrometric Identification of organic compounds*, John Wiley.

CH 231 Physical Chemistry I (2 credits)
(Prerequisites: CH 101, CH 102)
Quantum Mechanics (10 L): Evidence for quantization, dynamics of microscopic systems, the Schrödinger equation, quantum mechanical principles, postulates in quantum mechanics, operators and observables, superposition and expectation values, the uncertainty principle, probability functions, solutions of Schrödinger equation for 1-, 2-, and 3-dimentional systems, including the hydrogen atom;
Atomic Structure and Atomic Spectra (10 L): Bohr theory and the quantum mechanical description of the atom, orbitals and wave functions, LCAO method, bonding in solids.
Electrochemistry (10 L): Conductometry, electronic and ionic conductors, conductivity and molar conductivity, strong and weak electrolyte solutions, determination of limiting molar conductivity, Kohlrausch's law of independent migration of ions, determination of ionic concentrations, equilibrium constants and rate constants. Conductometric titrations, electrodes, electrochemical cells, applications of potentiometry, factors effecting cell e.m.f., Thermodynamic functions from emf measurements, potentiometric titrations.

Recommended Texts:

1. P.W. Atkins (1999), *Physical Chemistry*, Oxford University Press; D.A. McQuarrie,(1983) Quantum Chemistry, University Science Books.

CH 232 Molecular Properties, Molecular Spectroscopy and Spectroscopic Instrumentation (1 credit)
(Prerequisite: CH 231)
Electrical properties, dipole moment, intermolecular forces, magnetic properties, magnetic susceptibility, permanent and induced magnetic moments; Introduction to molecular spectroscopy; Rotational Spectra, vibrational spectra, electronic spectra, basic components of spectroscopic instrumentation.

Recommended Texts:

1. P.W. Atkins (1999), *Physical Chemistry*, Oxford University Press; W.J. Moore, *Introduction to Molecular Spectroscopy.*

PH 261 Medical Physics (2 credits)
Biomechanics of the human body: forces on and in the body, metabolism and energy balance of the body, fluid dynamics of the human circulatory system; Physics of the cardiovascular system and cardiovascular instruments: mechanics of cardiac contraction, pressure volume curves, ECG, pacemakers, defibrillators; Fiber optics in medicine: physics of fiber optics, endoscopes; Laser in medicine: physics of Laser, Laser treatment, Laser safety; Physics of diagnostic techniques: ultrasound imaging (MRI); Nuclear medicine and Radiation physics: properties of nuclear radiation, radioisotopes for nuclear medicine, radiopharmaceuticals, nuclear medicine instrumentation, radiation dosimetry, radiation protection.

Recommended Texts:

1. P. Davidovits (2001) *Physics in Biology and Medicine*, Harcourt/Academic
2. R.K. Hobbie (1997) *Intermediate Physics for Medicine and Biology*, Springer.
3. J.R. Cameron, J.G. Skofronic and R.M. Grant (1999) *Physics of the Body*, Madison: Medical Physics Publishing
4. R.S. Khandpur (2003) *Hand book of Biomedical Instrumentation*, Tata McGraw-Hill.
5. J.G. Webster (1998) *Medical Instrumentation: Application and Design*, Houghton Mifflin.

ST 202 Applied Statistics (2 credits)

This course cannot be offered by students who offered ST 101 or ST 201. Some practical assignments will be given for this course.

Types of data, Data summarization: Histogram, Frequency polygon, Ogive.

Measures of location, Measures of Dispersion, Representation of data using Stem-Leaf diagrams and Box plots. Some Statistical distribution functions and their properties.

Test of hypothesis, Estimation and tests on difference between two means and proportions, Tests on variances.

Simple linear regression and correlation, Lack of fit residual plots, Introduction to Analysis of variance, and analysis of two-way contingency tables.

Recommended Texts:

1. Harper W.M. (1991) S*tatistics*, ELBS
2. Moore D.S. (1995) T*he basic practice of Statistics*, W.H. Freeman & Company
3. Bluman A.G. (1997) *Elementary Statistics*, McGraw Hill

ZL 201 Animal Embryology (2 credits)

Gametogenesis; Fertilization; Cleavage; Gastrulation; Neurulation; Early development of amphioxus, frog, chick, and man; Early development of selected invertebrates.

Practicals based on above.

Recommended Texts:

1. *Animal Biology.* Grove & Newell
2. *Introduction to Embryology.* B.I. Balinsky.
3. *Langman's Medical Embryology.* T.W. Sadler & J. Langman.