

# PRINCIPAL SUBJECT AREA

## MOLECULAR BIOLOGY AND BIOTECHNOLOGY

### 100 LEVEL COURSES

#### BL 101 Basic Biology (2 credits)

*Cell Biology* - Chemical nature of life, origin of life, scientific method, prokaryotic and eukaryotic cells, cell types, structure and function of cell membranes and organelles, cell division, structure and function of genetic material.

*Classification of organisms* - Early and current systems of classification.

*Genetics and evolution* - Chromosome theory of inheritance, Mendelian genetics and deviation, linkage and recombination, mutations, Hardy-Weinburg principle, sources of variation, natural selection, origin of species. Laboratory exercises based on above topics.

#### Recommended Texts:

1. Campbell, N. A., Reece, J. B. and Mitchel, I. G. (1996). *Biology* 4<sup>th</sup> Edition. The Benjamin/Cummings Publishing Company, Inc.
2. Marder, S. S. (2001). *Biology* 7<sup>th</sup> edition. McGraw – Hill Book Company Inc., USA.
3. Raven, P. H. and Johnson, G.B. (1996). *Biology*. 4<sup>th</sup> Edition. Wm. C. Brown Publishers.
4. Tauro, P. Kapoor, K. K. and Yadav, K. S. (1986). *An Introduction to Microbiology*. Wiley Eastern Limited, New Delhi.
5. Winter, P. C., Hickey, G. T. and Fletcher, H. L. (2000). *Genetics*. 2<sup>nd</sup> Edition. Vivo Books Private Ltd., New Delhi.

#### CH 101 Principles of Chemistry I (3 credits)

*General Chemistry I* (15L): Modern view of the atomic structure and the development of the atomic theory of matter; Quantum mechanics and atomic theory: Electromagnetic radiation, atomic spectrum of hydrogen, Bohr model, the quantum mechanical description of the atom, electrons as waves, wave-particle duality, de Bröglie relationship, wave function and its physical meaning, Heisenberg's uncertainty principle; Electron spin and the Pauli exclusion principle, Aufbau principle and the periodic table, electron configurations of elements, periodic trends in atomic properties; Bonding, types of chemical bonds, electronegativity, polarity and dipole moment, ionic bond, ionic lattices, packing of spheres, partial ionic character of covalent bond; Covalent bond: covalent bond energies and chemical reactions, non-valence cohesive forces.

*Structure and Reactivity* (15 L): Types of intermolecular interactions; Factors affecting electron availability in bonds and at individual atoms; Acidity and basicity; Functional groups responsible for reactivity of different classes of organic compounds; Relationships between the main classes of organic molecules; Introduction to reaction mechanisms - bond cleavage processes, types of reagents and reaction intermediates; Energy diagrams; Mechanisms of substitution, addition and elimination reactions; Aromaticity and Huckel's Rule; Reactions in functional group analysis and their mechanisms. IUPAC Nomenclature

*Reactivity and Energetics* (15L): The scientific method, microscopic and macroscopic theories, Kinetic Molecular Theory (KMT): KMT as a model for microscopic theories, experimental evidence, properties of gases, the perfect gas, state of gases, individual gas laws, combined gas laws, kinetic model for gases, imperfect gases; Thermodynamics: Systems, surroundings, universe, processes, zeroth law of thermodynamics, temperature, first law of thermodynamics, work, heat, internal energy, extent of reaction, enthalpy, thermochemistry, second law of thermodynamics, entropy, Gibbs energy, Helmholtz energy, Gibbs energy versus extent of reaction, reaction quotient, exogernic and endogernic reactions, reactions at equilibrium, thermodynamic equilibrium constant, activity, temperature dependence of equilibrium constant, effect of concentration, pressure, volume, temperature, etc, on the position of equilibrium.

#### Recommended Texts:

1. R. Chang (2002) *Chemistry*, McGraw-Hill; P.W. Atkins (1994), *Physical Chemistry*, Oxford University Press.
2. J McMurry (1996) *Organic Chemistry*, Brooks/Cole Publishing Co.; RT Morrison and RN Boyd (1998) *Organic Chemistry*, Prentice Hall.

### **CH 102 Principles of Chemistry II (3 credits)**

(Prerequisite: CH 101)

**General Chemistry II** (15 L): Molecular structure: Lewis structures, explanations to octet rule; Three- center bond, resonance, the VSEPR model, hybridization of atomic orbitals, molecular orbital theory, bonding in homonuclear and heteronuclear diatomic models; Periodic table and periodicity, periodic properties, applications of size and energy factors in chemistry, magnetic properties; Basic concepts in chemical analysis: titrations, buffers, indicators, solubility equilibria and applications.

**Chemical Kinetics** (10L): Molecular collisions; The importance of chemical kinetics: Rates, mechanisms, relationship between rate of reaction and rate of change of concentration of components; Rate law, rate constant and order, overall order of a reaction, initial rate method, integrated rate laws, isolation method, half-life of a reaction and a relationship to rate constant, molecularity of a reaction, the Arrhenius relationship between temperature and rate of a reaction, activation energy and pre-exponential factor.

**Electrochemistry** (5L): Introduction to Electrochemistry, Conductometry and Potentiometry

**Stereochemistry and Spectroscopy** (15 L): Configurational isomers, E,Z-nomenclature, symmetry, chirality; R,S-nomenclature, meso compounds, diastereomers. conformations in acyclic and cyclic compounds, cis-trans and optical isomerism in cyclic compounds; Biphenyls, allenes, introduction to spectroscopy (UV, IR) and <sup>1</sup>H-NMR spectra.

Recommended Texts:

1. R. Chang (1996) Chemistry, McGraw-Hill; P.W. Atkins (1999), *Physical Chemistry*, Oxford University Press.
2. J McMurry (1996) *Organic Chemistry*, Brooks/Cole Publishing Co; RT Morrison and RN Boyd (1998) *Organic Chemistry*, Prentice Hall.

### **CH 108 Elementary Chemistry Laboratory (1 credit)**

Apparatus and measurements; Error analysis; Introduction to inorganic analytical method; Organic functional group analysis.

### **CH 109 Inorganic Chemistry Laboratory (1 credit)**

(Prerequisite: CH 108)

Qualitative analysis; Analysis of Inorganic anions, cations and their mixtures .Quantitative Inorganic analysis including titrimetry and gravimetry.