TOPICS ON BIOLOGY FOR ADMISSION TEST

1. Basic structure and characteristics of the eukaryotic cell (cellular organelles, structure, function).

2. Basic metabolic pathways: glycolysis, biological oxidation, photosynthesis (the biological role and basic characteristics of enzymes).

3. The DNA and its role in heredity: the structure of DNA, the genetic code, the replication of the genetic material.

4. Cell division I.: Chromatin, chromosomes. The behaviour of chromosomes during mitosis.

5. Cell division II.: Meiosis. The role of meiosis in sexually reproducing organisms.

6. Genetics I.: Genotype, phenotype, genes, alleles. Monohybrid cross, dominant-recessive type of inheritance, co-dominance. The first Mendelian law of inheritance.

7. Genetics II.: X-linked inheritance. Dihybrid cross: the second Mendelian law of inheritance. Genetic linkage, crossing-over.

8. From DNA to protein: Translation, mRNA, rRNA, tRNA, ribosomes.

9. Basic anatomy and physiology of the human respiratory system.

10. Basic anatomy and physiology of the human circulatory system.

11. Basic anatomy and physiology of the human digestive system.

12. Basic anatomy and physiology of the human excretory system.

13. Homeostasis: the basic structure and function of the human nervous system.

14. Homeostasis: hormones, the human endocrine system.

15. Basic structure and function of skeletal muscle cells, locomotion in humans.

16. The basic defense systems against infections: the humoral and cellular immune response in humans.

Textbook: Sadava, Heller, Orians, Purves, Hillis (ed.): *Life. The Science of Biology, 8th. Edition*. Sinauer Associates, INC., VHPS/W.H. Freeman and Co. Gordonsville, VA, U.S.A.

TOPICS ON CHEMISTRY FOR ADMISSION TEST

GENERAL CHEMISTRY

The SI system of measurement.
Classification of matter.
Elements, symbols of the elements.
The structure of atoms.
Atomic, molecular and molar mass relationships.
Chemical equations and stoichiometry.
Electronic structure of the elements: quantum numbers, orbitals, electron configuration.
Periodic table: main groups, periodic properties.
Types of chemical bonds.
Covalent bond: Lewis structures, molecular shapes, valence bond theory.
Intermolecular forces.
The gaseous state: The gas laws. Stoichiometric relationships with gases. Kinetic - molecular theory of gases.
Liquid and solid states. Phase changes.
Solutions and their properties: Concentration of solutions. Ions in aqueous solution: electrolytes and nonelectrolytes.
Chemical equilibrium. The equilibrium constant.
Acids and bases: The pH in solutions of strong acids and strong bases. Equilibria in solutions of weak acids and weak bases.
Thermochemistry: Energy changes and energy conservation. Expansion work. Energy and enthalpy. Hess's law.
Oxidation and reduction: Oxidation state. The activity series of the elements. Balancing redox reactions.

INORGANIC CHEMISTRY

Hydrogen and oxygen. Compounds of hydrogen and oxygen.
The halogens. Compounds of the halogens.
Noble gases.
Nitrogen, phosphorous, sulfur and their compounds.
Carbon, allotropic forms of carbon, inorganic carbon compounds.
The s- and p-block metals, transition metals.

ORGANIC CHEMISTRY

Covalent bonds of carbon, multiple covalent bonds in carbon compounds.
Hydrocarbons: alkanes, cycloalkanes, alkenes and alkynes.
Aromatic and heteroaromatic compounds.
Alcohols, phenols and ethers.
Aldehydes and ketones.
Carboxylic acids and substituted carboxylic acids.
Carboxylic acid derivatives: esters, amides, anhydrides.
Nitrogen containing organic compounds.
Isomerism in organic chemistry: structural, geometrical and optical isomers.

Textbook: McMurry, J., Fay, R.C. (2012): *Chemistry, 6th Edition*. Pearson Education, Inc., Upper Saddle River, NJ 07458.

TOPICS ON PHYSICS FOR ADMISSION TEST

MECHANICS
Motion in one dimension. Displacement, velocity, acceleration, motion diagram, freely falling objects.
Vectors and two dimensional motion. Displacement, velocity, acceleration in two dimensions.
The laws of motion. Forces, Newton's first, second and third law. Forces of friction.
Energy. Work. Power. Kinetic energy - work energy theorem. Systems and energy conservation. Kinetic, gravitational potential and spring potentional energy.
Momentum and collision, conservation of momentum.
Rotational motion and the law of gravity.
Rotational equilibrium and rotational dynamics. Torque and the conditions for equilibrium.
Solids and fluids. States of matter. Density and pressure. Archimedes principle.

THERMODINAMICS
Temperature and the Zeroth law of thermodynamics. The kinetic theory of gases. Thermal expansion of solids and liquids.
Energy in thermal processes. Heat and internal energy, specific heat.
The Laws of thermodynamics. Entropy.

VIBRATIONS AND WAVES
Hooke's law. Elastic potential energy. Simple harmonic motion. Motion of a pendulum.
Waves and interference of waves. Frequency, amplitude and wavelength.
Sound. Characteristics of sound waves. Doppler effect.

ELECTRICITY AND MAGNETISM
Electric forces and electric field. Electric charges. Insulators and conductors. Coulomb's law.
Electrical energy and capacitance. The parallel plate capacitor.
Current and resistance. Ohm's law. Temperature variation of resistance.
Direct current circuits. Resistors in parallel and series. Kirchoff's laws. RC circuits.
Magnetism. Magnetic fields. Motion of charged particles in magnetic field.
Induced voltage and inductances. Faraday's law of induction.
Alternating current. Resistors and capacitors in AC circuits.

LIGHT AND OPTICS
The nature of light. Reflection, refraction. Total internal reflection.
Polarization of light waves.
Mirrors and lenses. Image formation of flat mirror and thin lenses.

MODERN PHYSICS
The speed of light.
Einstein's principle of relativity.
Atomic spectra, the exclusion principle and the periodic table.
Binding energy, radioactivity.
Nuclear fusion and fission.
Elementary particles and fundamental forces.

Textbook: Raymond A. Serway, Jerry S. Faughn, Chris Vuille: *College Physics, 9th Edition*. Brooks/Cole, Cengage Learning, 2012