ADMISSIONS to 4-year MD, 6-year MD, 5-year DDS, 6-year PHARMD and 3-year PHYSIOTHERAPY PROGRAMS for the academic year 2015/2016

TOPICS TO PREPARE FOR WRITTEN TEST AND INTERVIEW

BIOLOGY

1. The Structure and Function of Large Biological Molecules.

2. Prokaryotic cell structure and function.

3. Eukaryotic cell structure and function.

Cell junctions. Local and long distant signaling. Chemical messengers. Receptors. The stages of cell signaling.

5. Cell cycle.

6. Cellular respiration and fermentation.
Catabolic pathways and production of ATP. The stages of cellular respiration (glycolysis, oxidation of pyruvate, citric acid cycle, oxidative phosphorylation). Anaerobic respiration. Types of fermentation.

7. Viruses.

8. Bacteria and Archaea.

9. Protists
Structural and functional diversity in Protists. Role of Protists in ecological communities.

10. Fungi.

11. Chromosomal and Molecular Basis of Inheritance.

12. Genetic mechanisms.

13. Tissues and body membranes.
Structure and physiology of: connective, muscle, epithelial and nervous tissue; serous, mucous, synovial and cutaneous membranes.


15. Nervous system.


17. Hormones and endocrine system.

18. Immune system. Innate and adaptive immunity.

19. Cardiovascular system.

20. Respiratory system.
Organization of human respiratory system. Negative pressure breathing. Hemoglobin.

21. Digestive system and nutrition.

22. Human reproduction and development.

23. Osmoregulation and excretion.


25. Ecology
Biotic and abiotic factors, habitats, niches, levels of organization, symbiosis, mutualism, parasitism, commensalism, trophic levels, nutrient cycles (water, carbon and nitrogen), food chains, primary producers, types of consumers, energy and biomass pyramids, limiting factors, tolerance, carrying capacity, adaptation, succession, climax community, pioneer species, biomes.

26. Genetics of population.
Genetic drift and effective population size, bottleneck effect, adaptation and phenotypic variance, Hardy-Weinberg equilibrium, maximum likelihood and Bayesian analysis.

CHEMISTRY

1. Atoms
Atomic theory
Elements and atomic number
Isotopes and atomic weight

2. The Periodic Table
The periodic table and some characteristics of different groups
Electronic structure of atoms and electron configurations
Electron configurations and the periodic table
Electron-dot symbols

3. Ionic Compounds
The octet rule, ions and ionic bonds
Periodic properties, ion formation formulas, naming ionic compounds
Some properties of ionic compounds
H⁺ and OH⁻ ions: an introduction to acids and bases

4. Molecular Compounds
Covalent bonds and the periodic table
Multiple covalent bonds and coordinate covalent bonds
Characteristics of molecular compounds
Molecular formulas and Lewis structures
Polar covalent bonds and electronegativity, polar molecules
Naming binary molecular compounds

5. Classification and Balancing of Chemical Reactions
Classes of chemical reactions
Chemical equations and balancing chemical equations
Acids, bases, and neutralization reactions
Redox reactions

6. Mole and Mass Relationships
The mole and Avogadro’s number
Gram–mole conversions

7. Reaction Rates and Chemical Equilibria
Endothermic and exothermic chemical reactions
Factors that influence chemical reaction rates
Chemical equilibrium
Equilibrium constants

8. Nuclear Chemistry
Radioactivity
Radioactive half-life

9. Physical quantities
Metric system of units
Metric units of length
Metric units of mass
Metric units of volume
Significant figures

10. Fundamental Chemical Laws
Law of conservation of mass
Law of definite proportions
Law of multiple proportions

11. Chemical Calculations
Mole concept and chemical formulas
Calculations involving chemical equations
Calculations involving volume and concentration

12. Solutions
Mixtures and solutions
Units of concentration
Dilution
Ions in solution: electrolytes

13. Acids and Bases
Acids and bases in aqueous solution, some common acids and bases
The Brønsted–Lowry definition of acids and bases
Acid dissociation constants. Acid and base strength
Some common acid–base reactions
Acidity and basicity of salt solutions

14. Buffers
Measuring acidity in aqueous solution: pH
Buffer solutions
Titration

15. Introduction to Organic Chemistry: Alkanes
The nature of organic molecules
The structure of organic molecules: alkanes and their isomers
Drawing organic structures
The shapes of organic molecules
Naming alkanes
Properties of alkanes
Reactions of alkanes

16. Cycloalkanes
Drawing and naming cycloalkanes

17. Alkenes and Alkynes
Alkenes and alkynes
Naming alkenes and alkynes
The structure of alkenes: cis–trans isomerism
Properties of alkenes and alkynes
Types of organic reactions
Reactions of alkenes and alkynes

18. Aromatic Compounds
Alkene polymers
Aromatic compounds and the structure of benzene
Naming aromatic compounds
Reactions of aromatic compounds

19. Alcohols
Some common alcohols
Naming alcohols
Properties of alcohols, acidity of alcohols
Reactions of alcohols

20. Phenols
Some common phenols
Acidity of phenols

21. Some Compounds with Oxygen, Sulfur, or a Halogen
Ethers
Thiols and disulfides
Halogen-containing compounds

22. Amines
Amines
Properties of amines
Heterocyclic nitrogen compounds
Basicity of amines
Amine salts

23. Aldehydes
The carbonyl group
Naming aldehydes
Properties of aldehydes
Some Common aldehydes
Oxidation of aldehydes
Reduction of aldehydes

24. Ketones
Naming ketones
Properties of ketones
Some Common ketones
Reduction of ketones

25. Carboxylic Acids and their Derivatives
Carboxylic acids and their derivatives: properties and names
Some common carboxylic acids
Acidity of carboxylic acids
Reactions of carboxylic acids: ester and amide formation
Hydrolysis of esters and amides

26. Amino Acids and Proteins
Amino acids structures
Acid–base properties of amino acids
Chemical properties of proteins

27. Enzymes and Vitamins
Catalysis by enzymes
How enzymes work
Vitamins and minerals

28. Carbohydrates
Classification of carbohydrates
The D and L families of sugars: drawing sugar molecules
Structure of glucose
Disaccharides, structure of maltose
Some important polysaccharides
Properties of carbohydrates

29. Lipids
Structure and classification of lipids
Fatty acids and their esters
Properties of fats and oils

30. Nucleic Acids and Protein Synthesis
DNA, chromosomes, and genes
Composition of nucleic acids
The structure of nucleic acid chains
Base pairing in DNA: the Watson–Crick model

PHYSICS

1. Dynamics
Force, mass, Newton's 1st, 2nd and 3rd law
Free-body diagrams
Contact forces: normal force and friction force
Linear momentum, impulse, conservation of momentum
Elastic and inelastic collisions, center of mass, translational motion

2. Electric currents
Electric current,
Ohm’s law, electrical resistance and resistors
Electric power
EMF and terminal voltage.
Resistors in series and parallel, Kirchhoff’s rules

3. Electric field
Electric charge, static electricity, induced charge, electric field, field lines, electric potential, equipotential lines, voltage,
Coulomb’s law
Electric field, conductors and dielectrics, charge distribution
Capacitance, storage of electric energy, capacitors in series and in parallel

4. Elements of kinematics and dynamics of circular and rotational motion
Angular velocity, angular acceleration, torque and rotational inertia
Angular momentum, conservation of angular momentum
Period, frequency, centripetal acceleration, centripetal force
Condition of equilibrium
Stability and balance

5. Elements of modern Physics: early quantum theory and models of the atom
Photon theory of light, photon energy, Planck’s constant
Photoelectric effect
Early models of the atoms, atomic spectra, the Bohr model: energy levels, transitions, absorption and emission
Wave-particle duality: the de’Broglie hypothesis

6. Fluids and solids
Mass and weight, specific density and specific gravity
Pascal’s principle, pressure, hydraulic lift
Archimedes’ principle, buoyancy and buoyant force
Elasticity, stress, strain, Hook’s law and Young’s modulus

7. Geometrical optics and wave nature of light
The ray model of light
Reflection of light, formation of image by plane mirrors and spherical mirrors, total internal reflection, fibre optics
Refraction, Snell’s law index of refraction
Thin lenses, focal point, focal length, optical power, ray tracing: converging and diverging lenses
The thin lenses equation; magnification, combination of lenses, lensmaker’s equation,
Magnifying glass, eye and corrective lenses
Huygens principle, diffraction, diffraction grating, interference, polarization

8. Kinematics
Vectors and scalars, vector components, addition of vectors
Frames of reference and displacement
Velocity and acceleration
Motion at a constant acceleration; falling objects
Projectile motion

9. Magnetism and electromagnetic induction, electromagnetic waves
Magnets and magnetic fields.
Magnetic field of straight wires and coils supplied with electric current
Force on an electric current in a magnetic field and on electric charge moving in a magnetic field
Faraday’s law of induction; Lenz’s law, electric generators, transformers and transmission of power
Electromagnetic waves and the electromagnetic spectrum, production of electromagnetic waves
10. Nuclear Physics and radioactivity
Structure and properties on the nucleus, nuclear size
Binding energy and nuclear forces
Radioactivity: alpha, beta and gamma decay; conservation of nucleon number and charge
The law of radioactive decay; the half-life time
Nuclear reactions and transmutation of elements
Nuclear fission and fusion, nuclear reactors

11. Sounds
Characteristics of sound
Sound intensity and intensity level, ear, sound loudness
Doppler effect
Sources of sound: vibrating strings and air columns, standing waves

12. Temperature and kinetic theory of gases
Temperature, kinetic theory of gases and molecular interpretation of temperature
Thermal Equilibrium and the Zero-th Law of Thermodynamics
The Ideal Gas Law
Heat and internal energy, First Law of Thermodynamics
Specific heat and latent heat
Heat engines, Second Law of Thermodynamics

13. Vibration and waves
Simple harmonic motion (SHL), energy in the SHL, conservation of energy in the SHL,
Simple pendulum, resonance, forced vibration
Wave motion, transverse and longitudinal waves
Energy transported by waves
Propagation of waves: reflection, refraction and diffraction

14. Work, power and energy
Work, kinetic energy, potential energy, power
Conservative and non-conservative forces
Conversion of mechanical energy, energy transformations
Work-energy principle