Topics Needed
for the Medical Programs Admission Exam (2027/2028)

Objective

The aim of admission exam for the medical programs (Pharmacy, Medicine, Dentistry and Health Sciences) is to assess candidates' aptitude and foundational scientific knowledge required for success and admission to these faculties. It evaluates conceptual understanding, analytical reasoning, and the abilities of students in solving problems in Biology, Chemistry, Physics and general knowledge for each program, in addition to critical-thinking skills.

Biology Topics

1. DNA, Chromosomes, Genetic Information, and Cell Cycle
- Karyotype: Definition and examples
- Genes, alleles, phenotype, genotype
- Cell cycle
- Mitosis
- Inter and intra-chromosomal shuffling; Test-cross; Crossing-over
- Structure and chemical components of chromosomes
- Genetic polymorphism: definition and detection
- Biological identity and genotype: Gene mapping and Genetic fingerprints
- Transmission of hereditary traits
- Chromosomal mutations and abnormalities with examples

2. Protein Synthesis
- Amino acids and proteins
- Transcription and translation
- Phenotypes and proteins

3. Fundamental Mechanisms of Sexual Reproduction
- Reproductive systems
- Diploid and haploid cells
- Meiosis
- Spermatogenesis and oogenesis

4. Regulation of Reproduction in Women
- Sexual cycle
- Endocrinology of the menstrual cycle
- Feedback control of gonadotropin secretion
- Assisted reproduction methods
- Contraception methods

5. Nervous System
- Organization of the nervous system in vertebrates
- Histology of the nervous system
- Main nerve pathways and centers
- Nature of the nerve message: Membrane potential, action potential, and ion channels
- Synapses and neurotransmitters
- Spinal reflexes: nerve circuits with examples of different types
- Directed motor function
- Cerebellum, basal ganglia, balance, and posture

- Effects of drugs on the nervous system
- Examples of neurodegenerative diseases

6. Immune System

- Self and non-self
- Immune system cells
- Non-specific immune response
- Specific immune response
- Induction of the specific immune response
- Humoral immune response
- Antibodies
- Antigens
- Autoimmunity
- AIDS
- Cancer
- Bacterial toxins
- Allergies and chemical mediators
- Vaccination and serotherapy
- Immunological memory

Chemistry Topics

1. Atoms

Structure, electron configuration, periodic classification of elements, valence electron, Lewis dot symbol, mole of atoms.

2. Molecules

Definition, classification (diatomic, polyatomic, molecular element, molecular compound), atomicity, polarity (of diatomic), stability (octet and duet rule), covalent bonding, VSEPR, mole of molecules.

3. Ions

Types (cations, anions), ionic compound, ionization equation, mole of ions.

4. Chemical reactions

Transformations, representation by equation, stoichiometry (limiting/excess reagents), chemical calculations, factors that affect rate, kinds of reactions, percent purity and percent yield**.**

5. Water

Natural and pure water, physical properties and importance, aqueous solution characteristics, concentration of aqueous solutions (molar, mass %, solubility), dilution problems**.**

6. Electrochemistry

Oxidation, reduction, redox couples, gamma rule, redox half-reaction, electrochemical cells and batteries.

7. Rate of reaction and kinetic factors

Rate of formation and rate of disappearance of a substance, Graphs of kinetics data, average rate, instantaneous rate and initial rate, Factors influencing reaction rate, rate constant, Half – life of a reaction, Catalysis.

8. Equilibrium

Homogeneous equilibrium, Equilibrium constants, Shifting equilibria: Le Chatelier’s Principle.

9. Organic Chemistry

Elemental analysis, Hydrocarbons, Aliphatic hydrocarbons, Organic Compounds containing oxygen or nitrogen and isomerism, Alcohols (Definition and general formula, Nomenclature, Structure and isomerism, Chemical properties), Aldehydes and ketones, Carboxylic acids and derivatives (Definition and general formula, Nomenclature, Chemical reactions, Acids derivatives)

10. Acid – Base Reactions in Aqueous Solutions. The pH scale.

Definitions and Measurement of pH, pH of the solution of strong acid, pH of a solution of strong base, Study of the pH changes that occur during the reaction between a solution of strong, acid and a solution of strong base, Equivalence point, Acid – Base titration, Weak acid, weak base, conjugate acid /base pair

Physics Topics

1. Mechanics I

- **Velocities and Motion:** position vector; velocity vector $\vec{v}$; acceleration vector $\vec{a}$; uniform rectilinear motion; uniformly accelerated rectilinear motion; uniform circular motion.
- **Forces:** tension in a string; reaction force of a plane surface; frictional forces; moment of a force about a fixed axis; equilibrium of a rigid body subjected to multiple forces; Newton's universal law of gravitation.
- **Linear Momentum:** Definition, conservation law and applications; various types of collisions (elastic and inelastic collisions).
- **Newton's Three Laws and Their Applications:** Vertical free fall; parabolic free fall of the center of mass of a rigid body in a uniform gravitational field; and other applications.
- **Oscillations:** Spring-mass system, differential equation and its solution.

2. Mechanics II

- **Work of a Force:** Work done by a constant force for rectilinear or curvilinear displacement; driving (motive) work and resisting work; work done by the weight of a body.
- **Kinetic and Potential Energy:** kinetic energy of a rigid body in translational motion; gravitational potential energy; elastic potential energy.
- **Mechanical Energy:** conservation of mechanical energy; non-conservation of mechanical energy.

3. Electricity

- **Electrostatics:** Electrification by friction, by contact, and by induction; electrostatic pendulum; electroscope $|q| = Ne$; Coulomb's law.
- **Electric Voltage:** Concept of electric voltage; polarity; laws of additivity and uniqueness; measurement using a multimeter and oscilloscope; direct and alternating voltage (DC & AC) voltage (AC); period and frequency; maximum voltage; peak-to-peak voltage; root mean square (rms) voltage of a sinusoidal signal.
- **Electric Current Intensity:** Conventional direction of electric current $|q| = I\Delta t$; ampere-hour; two laws related to current intensity; junction (node) law.
- **Ohmic Conductors:** Ohm's law; conductance; rheostat; measurement of resistance R; Joule's law: $P = UI$; $P = RI^2$; combinations of ohmic conductors; short circuit; electrical energy; the kilowatt-hour (kWh).
- **Generators and Receivers:** Characteristics and Ohm's laws; energy balance and efficiency.

- **Capacitors:** Capacitance; parallel-plate capacitor; charging and discharging; charge Q; breakdown voltage; stored energy; combination of capacitors in series and in parallel; applications.
  (*Note: The time constant, interpretation of charge and discharge curves, and differential equations are not included in the examination syllabus.*)

4. Geometrical Optics

- **Rectilinear Propagation of Light.**
- **Reflection of Light and Plane Mirrors.**
- **Refraction of Light:** Snell–Descartes laws of refraction; index of refraction $(n = \frac{c}{v})$.

Thin Lenses: converging and diverging lenses; image formation by a thin lens; conjugation and magnification formulas; combination of two separated thin lenses.

5. Waves

- **Mechanical Waves:** Progressive mechanical waves and periodic progressive mechanical waves; transverse waves; longitudinal waves; wave speed and wavelength; properties of wave propagation; physical nature of sound; ultrasound and infrasound; speed of sound in different media.

- **Light Waves**
  - Properties of light waves; monochromatic and polychromatic light; color, frequency, and wavelength in a vacuum; infrared and ultraviolet.
  - Diffraction of light through a slit $\theta = \frac{\lambda}{a}$
  - Light interference in air; path difference; bright and dark fringes; fringe spacing; source displacement.

6. Nuclear Physics

- **Atom:** Bohr's postulate; photon energy; emission spectra and absorption spectra. **Atomic nucleus:** nuclide; isotopes; approximate mass; mass–energy equivalence; mass defect; binding energy.
- **Radioactivity:** radioactive nuclei; conservation laws; α (alpha) radioactivity; β^- (beta minus) radioactivity; β^+ (beta plus) radioactivity; γ (gamma) radioactivity; random nature of radioactive decay; radioactive decay law; activity; energy balance.
- **Nuclear Fission and Fusion:** definitions; chain reactions; energy balance; controlled fusion.

7. Particle Nature of Light

- **Photoelectric Effect** (basic concepts).

Critical Thinking Questions

The primary objective of critical thinking questions is to evaluate applicants' ability to think logically, analyze information, and make sound decisions in complex situations relevant to healthcare professions. Rather than testing rote memorization, the questions aim to measure skills such as problem-solving, data interpretation, ethical reasoning, and scientific inquiry—competencies essential for success in health-related programs. By assessing how candidates approach real-world scenarios, interpret evidence, and apply reasoning principles, the test ensures that admitted students possess the cognitive foundation required for clinical judgment, research evaluation, and patient-centered care.

The program-oriented section consists of 20 questions for each program: Pharmacy, Medicine, Health Sciences and Dentistry.

Pharmacy Oriented Questions

The section of pharmacy orientation questions is applied to assess the applicants' general understanding of the pharmacy profession and the pharmacist's role in health care system. Moreover, the questions are designed to measure the degree of the applicants' awareness about medications that are used to treat the most common diseases. This section helps the faculty to identify and select applicants with the attribute's essentials for success as competent pharmacists.

Medicine Oriented Questions

Questions in the medical sections cover the student`s general knowledge about common diseases in our society. These diseases include non-communicable diseases like hypertension, diabetes, cardiovascular disorders, respiratory disorders, gastrointestinal system diseases (like diarrhea), strokes and infertility. In addition to communicable diseases which include infectious diseases caused by microorganisms like bacteria, viruses, fungi, or parasites and their common pathways of infection.

Health Sciences Oriented Questions

The oriented questions are designed to evaluate applicants' understanding of fundamental health concepts, human anatomy & physiology, and ethical considerations in patient care. By assessing critical thinking abilities, communication skills, and awareness of public health issues, the faculty aims to identify candidates who demonstrate a passion for improving health outcomes and a commitment to lifelong learning in the ever-evolving fields of Physical Therapy, Nutrition, Nursing, and Medical Laboratory Technology.

Dentistry Oriented Questions

The oriented questions assess general knowledge in dentistry, particularly in general dentistry, oral hygiene, and oral health care. It also evaluates critical thinking skills, quantitative reasoning abilities, and perceptual ability through a variety of targeted question types.