

Annex A
Syllabi for the admission test
SINGLE-CYCLE MASTER'S DEGREE COURSE IN
MEDICINE AND SURGERY (LM-41)
academic year 2026/2027

Admission to the course requires the ability to understand and analyse written texts of various types, to conduct logical-mathematical reasoning, as well as general knowledge, with special regard to historical, geographical, social, and institutional contexts, and specific knowledge in mathematics, chemistry, physics, and biology.

1. Reading skills and knowledge acquired during studies

The ability to understand written texts of various kinds in English with different communicative purposes constitutes a cross-cutting skill, as all types of questions will be formulated in English, including those using symbolic language.

The following abilities will also be specifically tested:

- Understanding abstract, uncommon, or specialized vocabulary in real-world contexts;
- Identifying phenomena of textual cohesion and coherence;
- Extracting and inferring specific information from the text.

These skills will be verified starting from short scientific non-fiction texts or classical and contemporary fiction, or from short current affairs texts published in newspapers and general or specialized magazines.

Always starting from short texts of various types and topics, the skills acquired during previous studies and general knowledge will be tested, including supranational contexts or topics subject to contemporary public debate. In particular, the questions will aim to assess:

- The ability to orient oneself in the represented space and time, i.e., to place significant historical-cultural phenomena in space and time;
- Knowledge of the main national and international institutions;
- The understanding of phenomena relating to the legal, economic, and citizenship fields.

2. Logical reasoning and problem-solving

The questions are aimed at testing the ability to logically complete an argument in a manner consistent with the premises. These premises are stated in symbolic or verbal form and focus on cases or problems, including those of an abstract nature, the solution to which requires the adoption of different forms of logical reasoning.

3. Biology

- The chemistry of living organisms.
- The biological importance of weak interactions.
- Organic molecules present in organisms and their respective functions. The role of enzymes.
- The cell as the basis of life. Cell theory. Cell size. Prokaryotic and eukaryotic cells, animal and plant cells. Viruses.

- The cell membrane: structure and functions; transport across the membrane. Cellular structures and their specific functions.
- Cell cycle and cell reproduction: mitosis and meiosis - chromosome complement and chromosome maps.
- Reproduction and heredity. Life cycles. Sexual and asexual reproduction.
- Mendelian genetics: Mendel's laws and their applications.
- Classical genetics: chromosomal theory of inheritance - inheritance models.
- Molecular genetics: structure and duplication of DNA, the genetic code, protein synthesis. Prokaryotic DNA. The structure of the eukaryotic chromosome. Genes and the regulation of gene expression.
- Human genetics: transmission of mono- and polyfactorial traits; autosomal and X-linked hereditary diseases.
- Mutations. Natural and artificial selection. Evolutionary theories. The genetic basis of evolution. Inheritance and environment.
- Biotechnology: recombinant DNA technology and its applications.
- Animal and human Anatomy and Physiology. Animal tissues. Anatomy and physiology of human systems and organs and their interactions. Homeostasis.
- Bioenergetics. The energy currency of cells: ATP. Redox reactions in living organisms. Energy processes: photosynthesis, glycolysis, aerobic respiration, and fermentation.

4. Chemistry

- The constitution of matter: states of matter; heterogeneous and homogeneous systems; compounds and elements.
- Ideal gas laws.
- Atomic structure: elementary particles; atomic number and mass number, isotopes, electronic structure of atoms of various elements.
- The periodic system of elements: groups and periods; transition elements.
- Periodic properties of elements: atomic radius, ionization potential, electron affinity, metallic character. Relations between electronic structure, position in the periodic system, and properties of elements.
- Chemical bonding: ionic bond, covalent bond, and metallic bond. Bond energy. Polarity of bonds. Electronegativity. Intermolecular bonds.
- Fundamentals of inorganic chemistry: nomenclature and main properties of inorganic compounds: oxides, hydroxides, acids, salts.
- Chemical reactions and stoichiometry: atomic and molecular mass, Avogadro's number, concept of mole and its application, elementary stoichiometric calculations, balancing simple reactions, different types of chemical reactions.
- Solutions: solvent properties of water, solubility, main ways of expressing the concentration of solutions.
- Equilibria in aqueous solution.
- Elements of chemical kinetics and catalysis.
- Oxidation and reduction: oxidation number, concept of oxidizing and reducing agents. Balancing simple reactions.
- Acids and bases: the concept of acid and base. Acidity, neutrality, and basicity of aqueous solutions. The pH. Hydrolysis. Buffer solutions.

- Fundamentals of organic chemistry: bonds between carbon atoms, empirical and structural formulas, concept of isomerism. Aliphatic, alicyclic, and aromatic hydrocarbons. Functional groups: alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides. Elements of nomenclature.

5. Mathematics

- Number sets and algebra: natural, integer, rational, and real numbers. Ordering and comparison; order of magnitude and scientific notation. Operations and their properties. Proportions and percentages. Powers with integer and rational exponents and their properties. Radicals and their properties. Logarithms (base 10 and base e) and their properties. Introduction to combinatorics. Algebraic expressions, polynomials. Notable products (special products), nth power of a binomial, factorization of polynomials. Algebraic fractions. First and second-degree algebraic equations and inequalities. Systems of equations.
- Functions: fundamental concepts of functions and their graphical representations (domain, codomain, sign analysis, continuity, maxima and minima, increasing and decreasing intervals, etc.). Elementary functions: integer and fractional algebraic, exponential, logarithmic, and trigonometric functions. Composite functions and inverse functions. Trigonometric equations and inequalities.
- Geometry: polygons and their properties. Circle and circumference. Measures of length, surface area, and volume. Isometries, similarities, and equivalences in the plane. Geometric loci. Measurement of angles in degrees and radians. Sine, cosine, and tangent of an angle and their notable values. Trigonometric formulas. Resolution of triangles. Cartesian coordinate system in the plane. Distance between two points and midpoint of a segment. Equation of a line. Conditions for parallel and perpendicular lines. Distance from a point to a line. Equations of the circle, parabola, hyperbola, and ellipse, and their representation in the Cartesian plane. Pythagorean theorem. Euclid's theorems (first and second).
- Probability and statistics: frequency distributions according to the type of variable and main graphical representations. Concept of random experiment and event. Probability and frequency.

6. Physics

- Physical quantities and their measurement: Fundamental and derived physical quantities. Systems of measurement units: International System (SI) and Technical System. Multiples and submultiples. Scientific notation. Main conversions between measurement units of different systems. Scalar and vector quantities. Vectors and vector operations.
- Kinematics: Description of motion. Velocity and angular velocity, acceleration and centripetal acceleration. Uniform linear motion, uniformly accelerated motion, uniform circular motion, simple harmonic motion.
- Dynamics: Concept of force as an interaction between bodies. Forces as applied vectors. The principle of inertia. Mass and the 2nd law of dynamics. Examples of forces: weight force, elastic force, static and dynamic friction. Action and reaction: the 3rd law of dynamics. Impulse and momentum. Principle of conservation of momentum. Moment of a force (torque) and angular momentum. Work and kinetic energy. Conservative forces and potential energy. Principle of conservation of mechanical energy. Power.
- Fluid mechanics: Density and compressibility of fluids. Gases and liquids. Hydrostatics: pressure and Pascal's, Stevin's (Stevinus), and Archimedes' principles. Liquid dynamics: one-

dimensional motion, flow and flow rate, continuity equation. Ideal fluids and Bernoulli's equation. Viscous forces in real fluids.

- Thermodynamics: Equilibrium, concept of temperature, thermometers. Concept of heat and calorimetry. Modes of heat propagation (transfer). Heat capacity and specific heat. Changes of state and latent heats. Ideal gas laws. First and second laws of thermodynamics.
- Electricity and electromagnetism: Electric charges. Forces between charges and Coulomb's law. Electric field and potential, equipotential surfaces. Dielectric constant, capacitance, capacitors. Electrostatic energy. Series and parallel capacitors. Generators. Electric voltage. Electric current. Resistivity, resistance, resistors. Ohm's law. Series and parallel resistors. Kirchhoff's laws. Work, Power, Joule effect. Direct and alternating current. Period and frequency. Magnetic field of an electric current. Forces on electric currents in a magnetic field. Electromagnetic induction.