

ANNEX A

Programs related to the subjects covered in the entrance examinations for the one-cycle Master's degree courses in Medicine and Surgery (LM-41), and Dentistry and Dental Prosthetics (LM-46), taught in English.

The admission criteria for the aforementioned degree courses include the ability to comprehend and analyze diverse forms of written text, engage in logical-mathematical reasoning, and possess a general knowledge base. This knowledge extends to historical, geographical, social, and institutional domains, as well as disciplinary expertise in mathematics, chemistry, physics, and biology.

The required skills and knowledge are aligned with the educational programs advocated and organized by the institutions that oversee teaching and instructional activities in accordance with the National Guidelines for secondary schools and the Guidelines for technical and professional institutes. This alignment is particularly important for State Examinations.

1. Reading skills and acquired academic knowledge

Competence in understanding written English texts of diverse genres and communicative purposes is a transversal competence, since all questions will be formulated in English, often using symbolic language.

The evaluation will distinctly assess the following skills:

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

Verification of these skills will commence with short texts of scientific essays or classical and contemporary narrative, or from short current affairs texts published in newspapers and generalist or specialized magazines. Always starting from short texts of various types and themes, the acquired skills in previous studies and general knowledge, even of supranational scope or of topics that are the subject of contemporary public debate, will be verified.

In particular, the questions will aim to ascertain:

- The ability to orient oneself in the space and time represented, or to place historical-cultural phenomena of significance in space and time.
- Knowledge of the main national and international institutions.
- Understanding of phenomena related to the legal, economic, and citizenship fields.

2. Logical reasoning and problems

The questions are designed to assess the ability to logically conclude an argument, consistent with the provided premises. These premises are stated in symbolic or verbal form, and they concern cases or problems, even of an abstract nature, which require the application of different logical reasoning techniques.

3. Biology

- ✓ The chemistry of living beings
- ✓ The biological importance of weak interactions
- ✓ The organic molecules present in organisms and their functions. The role of enzymes.
- ✓ The cell as the basis of life. Cellular theory. Cellular dimensions. The prokaryotic and eukaryotic cell, in animals and plants. Viruses.
- ✓ The cell wall: structure and functions – transport across the membrane. The cell organelles and their specific functions.
- ✓ The cell cycle and cellular reproduction: mitosis and meiosis – chromosomes and chromosome mapping.
- ✓ Reproduction and inheritance. Life cycles. Sexual and asexual reproduction.
- ✓ Mendelian genetics: Mendel's laws and their applications. Classic genetics: the chromosomal basis 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: the transmission of mono and poly-factorial characters; hereditary diseases linked to autosomes and the X chromosome.
- ✓ Mutations. Natural and artificial selection. The theories of evolution. The genetic basis of evolution. Inheritance and the environment.

- ✓ Biotechnology: the technology of recombinant DNA and its applications.
- ✓ Anatomy and physiology of systems in man and their relative interactions. Animal tissue. The anatomy and physiology of animals and man. Homeostasis.
- ✓ Bioenergetics. The energy levels of cells: ATP. Oxidation and reduction events in living organisms. Energy pathways: photosynthesis, glycolysis, aerobic respiration and fermentation.

4. **Chemistry**

- ✓ The composition of matter: Aggregate states of matter; heterogeneous and homogeneous systems; compounds and elements.
- ✓ The ideal gas laws.
- ✓ Atomic structure: elementary particles; atomic number and mass number, isotopes, the electronic structure of the atoms of the various elements.
- ✓ The periodic table: groups and periods; transition elements. The periodic properties of the elements: atomic radius, ionization potential, electronic affinity, metal characteristics. Relationship between electronic structure, positions in the periodic table and the properties of the elements.
- ✓ Chemical bonds: ionic bonds, covalent and metallic bonds. Bonding energy. Bonding polarity. Electronegativity. Inter-molecular bonds.
- ✓ The fundamentals of inorganic chemistry: nomenclature and principal properties of inorganic compounds: oxides, hydroxides, acids and salts.
- ✓ Chemical reactions and stoichiometry: atomic and molecular mass, Avogadro's number, the concept of mole and its application, elementary stoichiometric calculations, the balance of simple reactions, the various types of chemical reaction.

- ✓ Solutions: the solvent properties of water, solubility, the principal ways of expressing the concentration of solutions.
- ✓ Aquatic equilibrium.
- ✓ Elements of chemical kinetics and catalysis.
- ✓ Oxidation and reduction: oxidation number, the concept of oxidants and reductants. The equilibrium of simple reactions.
- ✓ Acids and alkalis: the concept of acid and alkalis. Acidity, neutrality and alkalinity of aquatic solutions. PH. Hydrolysis. Buffer solutions.
- ✓ The fundamentals of organic chemistry: carbon bonds, empirical and structural formulas, the concept of isomerism. Aliphatic, alicyclic and aromatic hydrocarbons. Functional groups: alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, starches. Nomenclature.

5. Mathematics

- ✓ Set theory and algebra, natural numbers, whole numbers, rational and real numbers, the order of numbers; order of magnitude and scientific notation. Operations and their properties. Proportions and their percentages. Exponentiation with real and rational exponents and their properties. Radicals and their properties. Logarithms (base 10 and base e) and their properties. Combined calculations. Algebra, Polynomials. Notable products. The binomial theorem. Algebraic fractions. First degree and second-degree linear equations and inequalities. Systems of equations.
- ✓ Functions: fundamental notions of functions and their graphic representations (dominant, codominant, maximum and minimum, increasing and decreasing etc.). Elementary functions: algebraic fractions, exponentials, logarithms, goniometry. Compound functions and inverse functions. Goniometric equations and inequalities.
- ✓ Geometry: polygons and their properties. Circumference and area of circles. Measurements of length surface area, and volume. Isometry: equivalence relations. Geometric forms. Measurements of angles in degrees and radians. Sine and cosine, tangents of an angle and

their values. Goniometric formulas. The resolution of triangles. Cartesian planes. Distance between two points and middle point of a segment. Line equations. Parallels and perpendicularity. Distance of a point from a line. Equations of circumference, parabola, hyperbola and ellipse and their representations on a Cartesian plane. Pythagoras theorem. Euclid's theorem (first and second).

- ✓ Probability and statistics. Frequency distribution according to type of character and principal graphical representations. Notions of casual experimentation. Probability and frequency.

6. Physics

- ✓ Physical quantities and how to measure them: Basic and derived physical quantities. Systems of units: International and technical. Multiples and submultiples. Scientific notation. Main conversions between 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 rectilinear motion, uniformly accelerated motion, uniformly uniform circular motion, harmonic motion.
- ✓ Dynamics: Concept of force as an interaction between bodies. Forces as vectors applied. The principle of inertia. Mass and the 2nd law of motion. Examples of forces: gravitational force, elastic force, static and dynamic friction. Action and Reaction: the 3rd law of motion. Impulse and momentum. Principle of Conservation of momentum. Momentum of a force and angular momentum. Work and kinetic energy. Conservation of energy and potential energy. Principle of Conservation of mechanical energy. Power.
- ✓ Fluid mechanics: Density and compressibility of fluids. Gases and liquids. Hydrostatics: Pressure and the principles of Pascal, Stevino and Archimedes. Dynamics of One-dimensional motion, flow and flow rate, continuity equation. Ideal fluids and Bernoulli's equation. Viscous forces in real fluids.
- ✓ Thermology, Equilibrium, concept of temperature, thermometer. The concept of Heat and

calorimetry. Modes of heat transfer. Heat capacity and specific heat. Changes of state and latent heat. Laws of perfect gases. First and second thermodynamic principles.

- ✓ Electricity and electromagnetism: Electric charges. Forces between charges and Coulomb's law. Electric field and potential, equipotential surfaces. Constant dielectric constant, capacitance, capacitors. Electrostatic energy. Series and parallel of capacitors. Generators. Electric voltage. Electric current. Resistivity, resistance, resistors. Ohm's law. Series and parallel of resistors. Principles of Kirchhoff. 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.

(*) This English translation is for information purposes only. The original Italian text is the legally binding version.