

## ANNEX A

Programmes regarding the questions contained in the entrance exam of the one cycle master degree course in Medicine and Surgery, and in Dentistry and Dental Prosthetics in English.

In order to be admitted to the courses, a general culture is required. Particular attention is paid to the literary, philosophical-historical, social and institutional fields, together with an ability in the analysis of various written texts and an aptitude in logical-mathematical reasoning.

Furthermore, the knowledge and abilities required are in line with the educational programmes organised by scholastic institutions that promote educational and didactic activities in accordance with the Ministerial Programmes, above all foreseen in State Exams and which also regard the scientific disciplines of Biology, Chemistry, Physics and Maths.

### **General culture and logical reasoning.**

The exam will measure the ability to use the English language correctly and to complete a form of logical reasoning in line with the task, which will be proposed symbolically or verbally in the form of multiple choice questions also with short phrases, where the applicant must exclude the wrong, arbitrary or least probable conclusions.

The questions will regard scientific texts, extracts of classic or contemporary authors, current affairs texts taken from newspapers or general and specialised magazines. The questions will also regard cases or problems of an abstract nature and the solutions to these questions will require various forms of logical reasoning.

General knowledge questions linked to students general secondary school education will complete the exam.

### **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.

Bioenergetics.

The energy levels of cells: ATP.

Oxidation and reduction events in living organisms.

Energy pathways: photosynthesis, glycolysis, aerobic respiration and fermentation.

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.

Biotechnology: the technology of recombinant DNA and its applications.

Inheritance and the environment.

Mutations. Natural and artificial selection. The theories of evolution. The genetic basis of evolution.

The anatomy and physiology of animals and man.

Animal tissue.

Anatomy and physiology of systems in man and their relative interactions.

Homeostasis.

## **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.

## **Physics**

Measurements: direct and indirect measurements, fundamental and derived units, the physical dimensions of units, the decimal system, the CGS System, Technical (or Practical) (ST) and International (SI), units of measurement (names and relationships between fundamental and derived units), multiples and submultiples (names and values).

Kinematics: kinematic units, motions with particular attention paid to uniform and uniformly accelerated linear motion; uniform circular motion; harmonic motion (for all motions: definition and relationship between connected kinetic units).

Dynamics: vectors and operations on vectors. Force, moment of a force about a point. Moment of a force couple. Vector composition of forces. Definition of mass and weight. Acceleration of gravity. Density and specific weight. Universal law of gravity, 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> principle of dynamics. Work, kinetic energy, potential energy. Principles of energy conservation. Impulse and quantity of motion. The quantity of motion and its conservation.

Fluid mechanics: pressure and its units of measurement (not only in the SI system). Archimedes' principle. Pascal's principle. Stevino's law.

Thermology, Thermodynamics: thermometry and calorimetry. Specific heat, thermal capacity. Heat dispersion. Changes of state and latent heat. The laws of ideal gasses. The first and second principles of thermodynamics.

Electrostatics and electrodynamics: Coulomb's law. Electric field and electric potential. The dielectric constant. Condensers. Parallel and series condensers. Continuous current. Ohm's law. Kirchhoff's principles. Electric resistance and resistivity, electrical resistance in series and in parallel. Work, Power, Joule effect. Generators. Electromagnetic induction and alternating currents.

Effects of electric current (thermal, chemical and magnetic).

## **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.