**PROGRAMMES FOR**

ADMISSION TESTS HELD AT UNIVERSITY

***Programme for Biology***

The programme is compiled on the basis of the mandatory minimum content of secondary (complete) general education and combines all the main substantive components of biological knowledge. The content of the programme includes the materials from all the sections of school biology: «Plants. Bacteria. Fungi. Lichens», «Animals», «Human being and Health» and «General biology».

Examination assignments and tests in Biology do not go beyond the scope of this programme, but require a deep study of all its elements. Successful answers to tasks require adequate and informed knowledge of biological concepts, theories and laws. The content of the admission tests includes tasks in a test form and questions that require a detailed written answer, therefore, applicants should have writing skills developed enough to provide competent wording and validity of conclusions, logical and concise presentation.

**The Programme Content**

**1. Plants. Bacteria. Fungi. Lichens.**

*The Flora* as an integral part of nature, its diversity. The value of plants in nature and human life. Plant protection.

*The Root.* The development of the root from the seed. Types of roots. Types of root systems. External and internal structure of the root. Root growth. Respiration in roots. The main functions of the root. Fertilizers. The importance of soil cultivation, fertilizing and watering. Variations of the roots.

*The Sprout.* The bud is an embryonic sprout. Leaf and flower buds. The structure of the bud. The development of sprout from the bud.

*The Leaf.* The external structure of the leaf. Venation. Simple and compound leaves. Leaf arrangement. Peculiarities of the microscopic structure of the leaf depending on its functions. Photosynthesis. Respiration in leaves. Evaporation of water by leaves. Variations of the leaves.

*The Stem.* Morphological forms of stems. Branching and crown formation. The internal structure of the stem of a woody plant in connection with the functions performed. Stem growth in length and thickness. The movement of mineral and organic substances along the stem. Modified shoots: rootstock, root tuber, bulb; their biological significance.

*Methods of vegetative reproduction* of flowering plants. Vegetative propagation using roots, leaves, stems, and modified shoots. The value of vegetative propagation.

*The Flower* as an organ of seed propagation. Flower structure: pedicel, receptacle, perianth, stamens and pestle. Same-sex and bisexual flowers. Monoecious and dioecious plants. The value of the flower in plant propagation.

*Inflorescences*, their diversity and biological significance. Cross pollination, self-pollination. Wind-pollinated and insect-pollinated plants. The formation of fruits and seeds. Types of fruits. The structure of seeds of monocotyledonous and dicotyledonous plants. The chemical composition of the seeds. Respiration in seeds. Nutrition and growth of seedlings. Distribution of fruits and seeds.

*The plant* as an integral organism. Plant tissue. The relationship of cells, tissues and organs. The main processes of plant life. Plant communities.

*The main departments of plants*.

*Algae.* The structure and activity of unicellular and filamentous green algae. Propagation of algae. Brown seaweed. The value of algae in nature and human life.

*Mosses.* The structure and reproduction (on a concrete example), complication in the process of evolution. Structural features of the sphagnum. Peat formation and its significance.

*Ferns*. The structure and reproduction (on a concrete example), amplification in the process of evolution. Ferns, horsetails, lycopodium. Role in nature.

*Gymnosperms.* The structure and reproduction (on a concrete example), complication in the process of evolution. Variety. Role in nature and in human economic activity.

*Angiosperms.* Features of the structure and functioning of angiosperms, their classification. Signs of classes of dicotyledonous and monocotyledonous plants. *Dicotyledonous* plants class. Characterization of the families of cruciferous, rosaceae, legumes, nightshade and compositae their significance in nature and human life. Monocotyledonous plants class.

Families: liliaceous, cereals. Distinctive features of plants of these families, their biological characteristics and significance.

*The origin of cultivated plants*. The concept of a kind in a variety. The most important agricultural plants (cereals, fruits and vegetables, vegetables, oilseeds, technical and others). The biological basis of their cultivation.

*Bacteria.* Features of the structure and vital functions of prokaryotic cells. Forms of bacteria. Propagation of bacteria. The spread of bacteria. The role of bacteria in nature and human life.

General characteristics of the kingdom of Fungi. Features of the structure and activity of pileate fungi. Yeast fungi. Mold fungi: penicillus and mucor. Fungi-parasites. Their structure, nutrition and reproduction. The value of fungi in nature and human activities.

*Lichens.* Features of the structure, nutrition and reproduction of lichens as symbiotic organisms. Variety of lichens. The role of lichens in nature and human life.

**2. Animals**

The main differences between animals and plants. Features of their similarity.

The diversity of the animal world.

*The Unicellular.* General characteristics. Habitat, structural and vital features of unicellular animals: movement, nutrition, respiration, reproduction (by the example of the common amoeba, Paramecium caudatum). The formation of cysts. The variety and importance of unicellular animals.

Coelenteratas. General characteristic of the type. Freshwater hydra: habitat, external structure, type of symmetry. Differentiation of cells in the intestinal. Nutrition, movement, regeneration and reproduction. Variety of Coelenteratas (coral polyps and jellyfish), their significance.

*The Flatworms. Ciliary Worms Class.* White Planarium: habitat, external structure, movement. Bilateral symmetry. Tissues, organs, organ systems of flatworms. *Flukes and Tapeworms Classes.* Features of the structure and life depending on the parasitic lifestyle. Life cycles of hepatic trematode and bovine tapeworm. Variety of flatworms. Harm to cattle breeding and people, control measures.

*The Roundworms*. Human roundworm: external and internal structure, vital activity and reproduction. Prevention of ascariasis.

*The Annelids*. General characteristic of the type. The oligochaete worms. Earthworm: habitat, external and internal structure. Regeneration, reproduction. The role of earthworms in soil formation. Polychaete worms. The amplification of annelids in the process of evolution.

*The Mollusks*. General characteristic of the type. Habitat. Features of the structure, nutrition, respiration, reproduction on the example of one of the representatives of the type. Variety of mollusks: classes of gastropods, bivalves and cephalopods. Their value in nature and human life.

*The Arthropods*. General characteristic of the arthropod type.

*The Crustacean class*. General characteristics of the class. Habitat, structural and living features, reproduction. Variety. Role in nature and human life.

*The Arachnids*. General characteristics of the class. Features of the structure, nutrition, respiration, reproduction and behavior of the spider-cross in connection with its life on land. Ticks. Features of the structure and living. Role in nature and human life. Tick protection measures.

*The Insects*. General characteristics of the class. Features of the structure, and life (on a specific example). Reproduction. Types of development of insects. Characteristics of the main orders of insects: Lepidoptera, Diptera, Hymenoptera. The value of insects.

*The Chordates*. General characteristics and origin of chordates. Structural features of the lancelet. Similarities with vertebrate and invertebrate animals.

*The Cartilage and Bone Fish*. General characteristics of the class. Features of the external and internal structure in connection with the habitat. Nervous system and sensory organs. Reflexes. Behavior. Reproduction and development. The ancient crossopterygian fish as the ancestors of Amphibians. The diversity and importance of fish.

*The Amphibians.* General characteristics of the class. The variety of amphibians (Urodelans and Anurans orders), their origin, significance and protection. Features of the structure, living and reproduction in connection with living in water and on land. The diversity and importance of amphibians.

*The Reptiles*. General characteristics of the class. Habitat, structural features, breeding, behavior in connection with life on land. Regeneration. The origin of reptiles. Ancient reptiles. The amplification of reptiles in the process of evolution. The variety of reptiles, their significance and protection.

*The Birds.* General characteristics of the class. The external structure. Features of the internal structure and living associated with flight. The behavior of birds. Reproduction and development, care for offspring. The adaptability of birds to seasonal phenomena in nature. Ecological groups of birds. Complication of the structure of the nervous system, sensory organs. The origin of the birds. The role of birds in nature and human life. Bird preservation.

*The Mammals.* General characteristics of the class. Features of the external structure, skeleton, muscles, internal structure and metabolism. Reproduction, development, care for offspring. The adaptability of mammals to seasonal phenomena in nature. The complication of the nervous system, sensory organs, behavior. The origin of mammals. Prototherians. Marsupials. Characteristics of placental units (insectivorous, bats, rodents, hares, predatory, pinnipeds, cetaceans, ungulates, primates). The role of mammals in nature and human life, their protection.

**3. Human Being and Health**

Features of the structure and living of the animal cell. The main tissues of the human body. Organs and systems of organs, the relationship of their structure with the functions performed. Nervous and humoral regulation of the functions of physiological systems. Human being and the environment.

*Locomotion system of a human being*. The similarity of the skeletons of humans and animals. Departments of the human skeleton. Features of the human skeleton associated with work and upright posture. Composition and structure of bones. Bone growth. Types of bone connection and their significance. First aid for bruises, sprains, dislocations and fractures. Muscles, their structure and functions. The main muscle groups. Muscle work. The influence of rhythm and load on the work of muscles. Muscle fatigue. Prevention of spinal curvature and the development of flat feet.

*Blood* and *blood circulation*. The internal environment of the body and its relative constancy. The importance of blood and blood circulation. Composition of blood, blood plasma. Blood coagulation. The structure and function of blood cells. Blood types, blood transfusion, donation. Immunity. The value of vaccinations. Circulatory: heart and blood vessels. The structure and work of the heart. The large and small circles of blood circulation. The movement of blood through the vessels, blood pressure, pulse. Regulation of the activity of the heart and blood vessels. Lymphatic circulation. Prevention of cardiovascular disease. First aid for bleeding. The harmful effects of smoking on the cardiovascular system.

*Respiratory system*. The value, structure and function of the respiratory system. Voice box. Respiratory movements. Gas exchange in the lungs and tissues. Vital capacity of the lungs. Neurohumoral regulation of respiration. Artificial respiration. Infectious diseases transmitted through the air. Prevention of airborne infections. Respiratory hygiene. The effect of air pollution on the human respiratory system.

*Digestive system*. Nutrients and foods. The concept of digestion. The role of enzymes in digestion. The structure and functions of the digestive system. Digestion in the oral cavity, stomach and intestines. Absorbtion. The importance of the liver and pancreas in digestion. Regulation of digestion. The role of I.P. Pavlov in the study of the functions of the digestive system. Food hygiene.

General characteristics of *metabolism and energy*. Plastic and energy exchanges, their relationship. The exchange of proteins, fats, carbohydrates in the human body. Water-salt metabolism. Vitamins, their importance in metabolism. Vitamins, hypovitaminosis, hypervitaminosis. Diet, regimen and nutritional standard.

*Urinary system*: structure and function. The formation of urine. The value of the allocation of metabolic products. Prevention of urinary diseases.

The structure and function of the *skin*. The role of skin in thermoregulation. Body conditioning. Skin hygiene. First aid for heat and sunstroke, burns and cold injuryies.

*Endocrine glands.* Their importance in the life and development of the body. Hormones. Intra-secretory activity of the pituitary gland, thyroid gland, adrenal glands, pancreas. Diseases associated with impaired activity of endocrine glands.

*Nervous system.* Its importance in the regulation and coordination of body functions and the implementation of the relationship of the organism with the environment. The central and peripheral nervous system of a person. The concept of reflex. The structure and functions of the spinal cord. The structure and functions of the brain. Cerebral hemispheres: lobes and functional areas. The role of the autonomic nervous system in regulating the functioning of internal organs. The harmful effects of nicotine, alcohol and drugs on the nervous system.

*Analyzers,* sensory organs, their values. The structure, functions and hygiene of visual and auditory analyzers. *Higher human nervous function* (HHNF). The role of I.M. Sechenov and I.P. Pavlov in the creation of the doctrine of higher nervous activity. Unconditioned and conditioned reflexes. The biological significance of the formation and inhibition of conditioned reflexes. Differences between human higher nervous activity and that of animals. Speech and thinking. Consciousness as a function of the brain. Social conditioning of human behavior. Sleep, its meaning and hygiene of mental work. The daily routine and its meaning.

*System of reproductive organs:* structure and functions. Fertilization and fetal development. Birth of a child. Care for a newborn. Personal hygiene of adolescents.

**4. General Biology**

Biology is the science of life. Methods of biological research. Levels of organization of living matter.

*The basics of cytology*. The cell is a structural and functional unit of the living. Chemical elements of cells. Inorganic compounds of the cell. The role of water in the cell and the body. Organic substances of cells: carbohydrates, lipids, proteins, nucleic acids, ATP; their role in the cell.

The structure of the eukaryotic cell. Cell wall and outer cell membrane: structure and functions. Protoplasm and cytoplasm of the cell. Nucleus: its structure and functions. Chromosomes and chromatin. Vacuolar cell system: endoplasmic reticulum, Golgi apparatus, lysosomes, vacuoles. Mitochondria and plastids. Non-membrane organoids: ribosomes, cytoskeleton, cell center, motion organoids. Cellular inclusions. Structural features of prokaryotic cells. Comparative characteristics of the structure of plant and animal cells. The provisions of cellular theory.

Metabolism and energy conversion are the basis of cell activity. Classification of organisms by energy source and type of nutrition. Energy metabolism in the cell (on the example of glucose oxidation), its meaning, the value of ATP. Photosynthesis: light and dark phases, meaning. Chemosynthesis. Gene, genetic code and its properties. Protein biosynthesis: transcription and translation. Matrix synthesis reactions. The relationship of plastic and energy exchanges.

Non-cellular life forms (viruses). The structure, reproduction of viruses. Human viral diseases. AIDS Prevention.

*Reproduction and individual development of organisms*. Somatic and germ cells of a multicellular organism. Chromosomes, haploid and diploid set of chromosomes. Homologous chromosomes.

Cell cycle. Interphase The mechanism and biological significance of mitosis. Meiosis – reduction division, mechanism and biological significance of meiosis.

Spermatogenesis and ovogenesis in animals. Fertilization in animals. Double fertilization of flowering plants.

Ontogenesis. Embryonic and postembryonic development. Direct and indirect postembryonic development. Forms of reproduction of organisms: asexual and sexual. Methods of asexual reproduction (mitosis, spore formation, fragmentation, budding, vegetative propagation). Sexual reproduction of organisms. Parthenogenesis. Hermaphroditism.

*The basics of genetics*. Genetics as a science, its tasks and research methods. The basic concepts of genetics: heredity, variability, dominant and recessive traits. Allelic genes. Phenotype and genotype. Heterozygous and homozygous organisms. Patterns established by G. Mendel for mono- and dihybrid crosses: the rule of uniformity of hybrids, the law of splitting, the gamete purity hypothesis, the law of independent inheritance of traits. Their cytological basis. Genotype as an integral historically developed system. Interaction of non-allelic genes. Testcrossing. Genetic linkage. Chromosomal theory of heredity. Genetics of the sex. Inheritance of sex-linked traits. Human genetics. Methods of studying human heredity. Hereditary human diseases. The importance of genetics for medicine and health.

Inherited and non-inherited variation. Classification of mutations. Mutagens. Artificial mutagenesis. Mutations as a material for natural and artificial selection. The law of homologous series in hereditary variation of N.I.Vavilov. Modified Variability. Reaction rate. Statistical patterns of modification variability.

*The basics of selection*. Breeding as a science, its tasks. The value of the work of N.I. Vavilov for the development of selection. The main methods of plant breeding. Features and methods of animal breeding. Types of breeding animals. Methods for the selection of microorganisms. Biotechnology, its significance and main directions: microbiological synthesis, genetic and cellular engineering.

*The basics of ecology*. Ecology: subject, tasks and research methods. Habitat. Features of aquatic, land-air, soil and organismic habitats. The adaptability of organisms to living in various environments. Environmental factors: abiotic, biotic, anthropogenic; their complex effect on the body. Patterns of the influence of environmental factors on the body.

Ecological characteristics of the population. Population structure. The dynamics of the population. Factors that influence the population numbers. Relationships of individuals in populations.

The concept of community, biogeocenosis, ecosystem. The structure and organization of biogeocenosis. The diversity of populations in biogeocenosis, their relationship. Types of interactions of individuals in biogeocenoses. Food chains and trophic networks. Self-regulation and stability of biogeocenoses. Change of biogeocenoses. Agrocenoses. Protection of biogeocenoses.

*Fundamentals of evolutionary doctrine*. The Pre-Darwinian period in Biology: the importance of the works of C. Linnaeus and J.-B. Lamarck. Prerequisites for the emergence of the teachings of Darwin. The main provisions of the theory of evolution of C. Darwin.

A population is a unit of species and evolution. Driving forces of evolution: natural selection, struggle for existence, hereditary variability, mutations, isolation, gene drift, population waves, gene flow. Natural selection as a leading evolutionary factor. Types of selection . The mechanism of occurrence of adaptations. The relative nature of adjustment.

Species: criteria and structure of the species. Speciation. Evidence of evolution. Biological progress and regression. Ways to achieve biological progress.

*The development of the organic world*. The origin of life on earth. The development of the world in the Archean, Proterozoic, Paleozoic, Mesozoic and Cenozoic era. The main aromorphoses.

*Human Origins*. Driving forces of anthropogenesis: social and biological factors. The oldest, old, fossil humans of the modern type. Human races, their origin and unity.

*Fundamentals of the doctrine of the biosphere*. Geospheres of the Earth. Biosphere and its boundaries. V.I. Vernadsky on the emergence of the biosphere. Living, inert and bioinert matter, their properties. The functions of the living matter, the role in the cycle of matter and the conversion of energy in the biosphere. Biosphere during the period of scientific and technological progress. The role of a human being in nature. The concept of the noosphere. Environmental pollution

**RECOMMENDED READING**

*Viktorov V.P.,Nikishov A.I. Biology*: Plants. Bacteria. Fungi and Lichen. Study guide for students of secondary schools. – М., 2002.

*Dolnik V. R., Kozlov М. А*. Zoology. Invertebrates. Course book. – Saint-Petersburg, 1997.

*Dolnik V. R., Kozlov М. А*. Zoology. Chordates. Course book. – Saint-Petersburg, 1997.

Kemp P*., Arms К. Introduction to Biology*. – М.: Mir Publishing house.1988

*Kolesov D. V.* et al. Biology. Human being: Course book for students of secondary schools– 2nd edition – М., 2001.

*Zakharov V. B., Mamontov S.G., Sonin N.I. Biology*. General patterns. 9th grade: Course book for students of secondary schhols. – М., 2000.

*Zakharov V. B., Mamontov S.G., Sonin N.I. Biology*. General Biology: Course book for 10-11 grades of secondary schools. – 6th edition. – М., 2003.

*Mamedov B.M. Biology*. Forms and levels of life. Study guide for students. – М.: Prosveschenie Publishing House. 1994.

*Novoseltseva G.D. Новосельцева Г.Д*. Lecture course on the basics of evolutionary doctrine. Study guide. RSMU. – М. 1996

General Biology: Study guide for 10-11 grades of secondary schools/ Edited by Yu.I.Polyansky. – М.: Prosveschenie, 1991.

General Biology: Study guide for 10-11 grades of secondary schools/ Edited by D.K. Belyaeva, А.О. Ruvinsky. – М., 1993.

*Ruvimsky А.О., Vysotskaya А.L., Glagolev S.М. et al. General Biology*. Study guide for 10-11 grades of secondary schools with an extensive course of Biology.- М.: Prosveschenie, 1993

Chepurkova К.Е., Novoseltseva G.D. Regulation of vital functions of an organism (Biology: Human being and health). A study guide on human anatomy for university applicants.