

# Subject Areas for MSc. Admission Exams

## Study program Biotechnology and Food Science

### Subject area „Chemistry”

1. Organic and inorganic bonds, hybridization, non-bonded interactions, molecule polarity. Hydrophilic, hydrophobic and amphiphilic molecules.
2. Structure of organic compounds (hydrocarbons, alcohols, aldehydes, ketones, acids, amino acids, including amino derivatives), their properties, stereochemistry and conformation.
3. Reactions of inorganic and organic compounds. Stoichiometry. Energy chemical reactions. Kinetics, rate and order of reactions. Chemical equilibrium.
4. Law of conservation of mass. Amount of substance. Different descriptions of concentration.
5. Equation of state and behaviour of ideal gas. Real gases. Physicochemical properties of gases, liquids and solids.
6. I. and II. Laws of thermodynamics. Enthalpy, entropy, internal energy, heat, work. Acid-base equilibria, definitions of acids, bases, pH.
7. Phase equilibria of single-component systems. Equilibria of multi-component systems. Dispersion systems.

### Subject area „Biology”

1. Structure and function of biomolecules and biopolymers (proteins, peptides, saccharides, lipids), their basic characteristics, significance and interaction.
2. Enzymes, structure, function, kinetics, inhibition.
3. Prokaryotic and eukaryotic cell structure. Viruses and viral reproduction.
4. Biological membranes. Membrane transport.
5. Genetic information, its transcription and expression.
6. Microbiology – taxonomy, isolation, cultivation and identification.
7. General characteristics of metabolism. Basic metabolic pathways and regulation. Bioenergetics. Cell physiology.

### Subject area „Biotechnology and Food related disciplines”

1. Metabolism of carbohydrates, lipids and nitrogenous substances.
2. Transport mechanisms in prokaryotic and eukaryotic cells.
3. Growth and reproduction of microorganisms, growth curve, environmental impact on cell growth, morphology, physiology and genetics of microorganisms. Application of microorganisms in biotechnology and food technologies.
4. Fundamentals of gene engineering (recombinant technology). Transmission and expression of genetic information. Application of gene engineering in biotechnology.
5. Bioprocess. Bioreactors. Types and regulation of cultivation processes. Examples of biotechnological processes.

6. Unit operations in biotechnologies and food industry (mixing, filtration, diffusion, heat exchange, adsorption, extraction, distillation, drying, membrane techniques etc.).
7. Analytical and separation methods for the study of biological systems (chromatography, electrophoresis, dialysis, immunochemical techniques, PCR, membrane separations).
8. Overview of biotechnologies and food technologies. Ecology and sustainability.
9. Basic food constituents and food industry raw materials, their importance for human nutrition.
10. Nutrition, inhibition of chemical, enzymatic and microbiological changes. Food packaging.
11. Health-conscious food production quality assurance. Health risks associated with dietary exposure to toxic and antinutritional agents.
12. Basic concepts of informatics and bioinformatics. Image analysis.