ANNOTATION
of the discipline
"Protein engineering and nanobiotechnologies "

The program “Protein engineering and nanobiotechnologies” is an interdisciplinary course. While having a fundamental basis, protein engineering plays a crucial role in the development of biotechnology. Protein engineering studies the theoretical basics and methods of the application of genetic material, which in turn has a wide applied meaning as it allows to construct recombinant molecules of DNA and genetically modified organisms via the improvement of the microorganisms and *de novo* construction of new unique technologies of synthesis of valuable products.

The program will be realized through the lectures, seminars, interactive courses, independent studies, independent creative work aimed to resolve direct tasks, preparations and presentations of reports based on the literature and practical courses. The knowledge of the students will be checked via supervised tests, interviews, short theses, courseworks and exams.

Current discipline consists of two separate, however closely related to each other parts – the “Protein Engineering” and “Nanobiotechnologies”.

The first part, “Protein engineering” involves the following questions: Introduction; The history of the establishment of protein engineering; The main functions of proteins; The structure and function of protein molecules; In vitro construction of proteins; Rational design and redesign of protein molecules; Directed evolution of the proteins; Biochemistry of protein molecules; In vivo contruction of proteins; The achievements of protein engineering; The application of protein engineering for the search of polypeptides corresponding to the modern requirements of biotechnology.

The second part, “Biotechnologies”, involves the following questions; Introduction; The main meanings and characterization of the sciences about nanosystems and nanobiotechnologies; The history of the occurance of nanobiotechnologies in the sciences about nanosystems; Multidisciplinarity and Interdisciplinarity; The structural and functional aspects of nanobiotechnologies; Nanoobjects and nanosystems, their features and technological applications; The objects and methods in nanobiotechnologies; Biofunctionalization of nanomaterials; The feutures of physical interactions in nanoscale systems; The main principles of the formation of nanosystems; Physical and chemical methods in nanobiotechnology; “Up – down” methods of synthesis of nanoobjects; “Down – up” methods of synthesis of nanoobjects; Classification of nanoparticles and nanoobjects; The examples of molecular modelling of nanostructures, molecular switchers, proteins, biomembranes, ion channels, molecular machines; The study methods and diagnostics of nanoobjects and nanosystems; The usage of proteins and peptides for the solving of the tasks in nanobiotechnology; The usage of polysaccharides as nanobiomaterials; Nanostructures formed by lipids, biomembranes; The active center of the enzyme as a functionalized nanoparticles or nanomachine; The application of viral structures as tools for nanotehcnologies; The size effects in nanoscale in protein catalysis; Nanobioanalytical systems; Biosensors; Nanobiosecurity; Mytotechnologies; The application of nanotechnologies in medicine; The principles and perspectives of the development of nanobiotechnologies.