Abstract of a selective discipline

Name of the discipline	**Nanotechnology in aquaculture**
Lecturer	Bityutskyy Volodymyr doctor of agricultural sciences, professor, head of the ecology and biotechnology department
The course and semester in which the study of the discipline is planned	6th year, 3rd semester (masters)
Faculties where the students are offered to study the discipline	Faculty of Ecology
List of competencies and learning outcomes provided by the discipline	**Expected competencies:** *Integral competence:* Ability to solve complex tasks and problems of research and / or innovation in the field of aquatic bioresources and aquaculture General competencies GC01. Ability to use information and communication technologies. GC02. Ability to search, process and analyze information from various sources GC05. The desire to preserve the environment. Special competencies SC02. Ability to integrate knowledge and solve complex problems of aquatic bioresources and aquaculture in broad or multidisciplinary contexts. SC07. Ability to carry out measures to protect aquatic bioresources and preserve fish health and prevent mass disease. SC10. Ability to clearly and unambiguously communicate their own knowledge, conclusions and arguments on the problems of aquatic bioresources and aquaculture to specialists and non-specialists, including students SC12. Ability to substantiate, plan, perform and summarize scientific applied research on aquatic bioresources and aquaculture Learning outcomes for the discipline PO.01 Have specialized conceptual knowledge, including modern scientific achievements of nanotechnology in the field of aquatic bioresources and aquaculture and is the basis for original thinking and research. PO.05 Ability to plan and carry out scientific research related to aquatic bioresources and aquaculture using nanotechnology. Be able to develop applied aquaculture projects aimed at using nanotechnology to improve the efficiency of production processes; apply an interdisciplinary approach to the development of innovative solutions for aquaculture that include nanotechnology. PO.06 Ability to plan, develop and implement innovative nanotechnological processes in the production of aquaculture products and ensure their quality. Be able to use nanomaterials and nanostructures to improve the efficiency of technological processes in the field of aquaculture. PO.10 Ability to develop scientific plans that include the use of nanotechnology to solve problems of aquatic bioresources and

	aquaculture. Be able to conduct research using nanomaterials and nanotechnology. Ability to formulate scientific hypotheses involving the use of nanotechnology in the study of aquatic bioresources and aquaculture; conduct experimental tests of these hypotheses using nanotechnology methods. Ability to choose appropriate nanotechnological methods and tools for researching aquatic bioresources and aquaculture problems
Discipline description	
Prerequisites needed for studing the discipline	The following prerequisites are necessary for the successful study of the discipline "Nanotechnology in Aquaculture", which is an elective component of the EPP: Basic knowledge of biology and ecology: understanding of the basic principles of biology of aquatic organisms, their anatomy, physiology, and ecological relationships in aquaculture systems. Knowledge of general and organic chemistry, in particular chemical reactions, properties of substances, and processes occurring in the aquatic environment: the basics of physics, especially in terms of physical properties of materials, principles of action of various types of radiation and their interaction with substances at the nanoscale. Basic knowledge of biotechnology, including genetic engineering, biosensors and biocatalysts. Knowledge of aquaculture fundamentals: knowledge of aquatic organism rearing and breeding methods, technologies used in aquaculture, and management of aquaculture systems. Analytical methods: skills in using analytical methods to investigate the properties of nanomaterials and their effects on aquatic organisms, including spectroscopy, microscopy, and other techniques. These prerequisites will help students to better understand and absorb the course material, as well as effectively apply the acquired knowledge in practice in the field of nanotechnology in aquaculture.
The maximum number of students who can study at the same time	25 students
Topics of in-class activity	**Topics of lectures** Topic 1: Introduction to nanotechnology Topic 2: Nanotechnology for water quality control Topic 3: Nanotechnology in aquaculture feeding Topic 4: Diagnosis and treatment of diseases Topic 5: Environmental and ethical implications of nanotechnology in aquaculture **Topics of practical classes** 1.Safety rules and working methods in a nanotechnology laboratory . This practical work is devoted to familiarizing students with the basic safety rules, methods of work and use of equipment in a nanotechnology laboratory specializing in aquaculture. 2. Ecological "green synthesis" of Argentum nanoparticles using Aloe vera plant extract. 3. Bio-nanotechnological synthesis of Argentum nanoparticles

	of different morphology with the participation of brewer's or baker's yeast Saccharomyces cerevisiae at different pH of the medium 4. Determination of iron content in water after purification by nanosorbents (part 1) 5. Spectrophotometric method of analysis. Determination of iron content in water by spectrophotometry 6. Determination of the degree of water purification from heavy metal ions by ultrafiltration and nanofiltration in closed water supply systems for fish farming 7. Biological transformation of selenite into nanoselenium with the participation of lactobacilli 8. Ecological biotechnology of “green” synthesis of zinc oxide nanoparticles and their insecticidal properties 9. Synthesis of nanoparticle conjugates with biologically active compounds as a drug transport system for the treatment of aquaculture diseases 10. Synthesis of nanobiosensors for the diagnosis of aquaculture diseases
Language of teaching	Ukrainian