**Al-Farabi Kazakh National University**

**Faculty of biology and biotechnology**

**Department of Biotechnology**

**Final exam program by discipline**

# Environmental Biotechnology

«6B05103 – Biotechnology»

**Almaty 2023**

# The program of the final exam of the discipline Environmental Biotechnology

of the specialty “6B05103 – Biotechnology” was compiled by A.K. Yernazarova, candidate of biological science, senior lecturer

Considered and recommended at the meeting of the department of Biotechnology

from year, protocol №

Head of department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kistaubaeva A.S.

 *(Signature)*

### Recommended by the methodological council of the faculty

« » \_\_\_\_\_\_ year, protocol № 5

Chairman of the methodological council of the faculty \_\_\_\_\_\_\_\_ Asrandina S. Sh.  *(Signature)*

**The exam in the discipline "Environmental Biotechnology" will be conducted in the oral form in the MS Teams system, according to the schedule.**

To take an oral exam, a student on an exam schedule contacts the instructor through the online Univer platform. During the exam, a video recording of the exam will be made and saved for 3 months from the day of the end of the session.

The ticket contains 2 questions. There are 30 questions in total.

The first block includes questions of cognitive (cognitive) competence, assessing knowledge and understanding of the educational object. This task is aimed at determining the ability of students to demonstrate knowledge and understanding of the mechanisms of resistance of microorganisms with different cellular and subcellular organization (bacteria, archaea, unicellular eukaryotes) to different extreme environmental conditions. Estimated at 40 points.

The second block consists of questions of systemic and functional competences, assessing knowledge about innovative research methods that make it possible to understand the mechanisms of survival of microorganisms of different physiological groups (bacteria, archaea, eukaryotic microorganisms) in extreme environmental conditions, and assess the ability to apply and analyze the knowledge gained in practice. Estimated at 60 points.

**Exam preparation topics**

**1st block of questions:**

Types of pollutants. The main sources of pollutants. The Role of Plants in Environmental Biotechnology. Phytoremediation of wastewater, solid waste and air pollutants. Bioremediation of oil contaminated soil. Bioremediation of heavy metals. Bioremediation of Radioactive Waste. Role of microorganism in Environmental Biotechnology. Microbial leaching. The metabolic capabilities of the microorganism. Microbial remediation of contaminated lands.

**2nd block of questions:**

Biotransformation of pesticides. Immobilization of Cells Application in Environmental Biotechnology. Use microorganisms for solving Environmental problems. Microbial products for Environmental Biotechnology. Biopesticides. Biofertilizers. Bioenergy. Bioinsecricides. Microbial enhanced oil recovery.

**Recommended sources of literature for exam preparation**

**Main:**

1. Environmental Biotechnology [2008]. ISBN 9788122425444
2. Eugene L. Madsen. Environmental Microbiology, From genomes to biogeochemistry [2008]. ISBN-13: 978-1-4051-3647-1.
3. Environmental biotechnology : biodegradation, bioremediation, and bioconversion of xenobiotics for sustainable development [2016]. Edited by Jeyabalan Sangeetha, Devarajan Thangadurai, Muniswamy David, Mohd Azmuddin Abdullah. ISBN 978-1-77188-362-7.
4. Environmental Microbiology and Biotechnology: Volume 1: Biovalorization of Solid Wastes and Wastewater Treatment [2020] / [Anoop Singh](https://ru.b-ok.asia/author/Anoop%20Singh), [Shaili Srivastava](https://ru.b-ok.asia/author/Shaili%20Srivastava%22%20%5Co%20%22%D0%9D%D0%B0%D0%B9%D1%82%D0%B8%20%D0%B2%D1%81%D0%B5%20%D0%BA%D0%BD%D0%B8%D0%B3%D0%B8%20%D0%B0%D0%B2%D1%82%D0%BE%D1%80%D0%B0), [Dheeraj Rathore](https://ru.b-ok.asia/author/Dheeraj%20Rathore), [Deepak Pant](https://ru.b-ok.asia/author/Deepak%20Pant). ISBN 9789811560217
5. Environmental Microbiology and Biotechnology Volume 2: Bioenergy and Environmental Health [2021]. Edited by Anoop Singh, Shaili Srivastava, Dheeraj Rathore, Deepak Pant. ISBN 9789811574931
6. Gareth Price. Biology: An Illustrated Guide to Science [2006]. ISBN-10: 0-8160-6162-9.
7. Environmental Biotechnology: For Sustainable Future [2019] / [Ranbir Chander Sobti](https://ru.b-ok.asia/author/Ranbir%20Chander%20Sobti), [Naveen Kumar Arora](https://ru.b-ok.asia/author/Naveen%20Kumar%20Arora), [Richa Kothari](https://ru.b-ok.asia/author/Richa%20Kothari). ISBN 9789811072840.
8. Principles and Applications of Environmental Biotechnology for a Sustainable Future [2017]. ISBN 811018669.

Additional:

1. Nathan S. Mosier, Michael R. Ladisch. Modern biotechnology: connecting innovations in microbiology and biochemistry to engineering fundamentals [2009]. ISBN 978-0-470-11485-8.
2. Tortora, Gerard J. Microbiology: an introduction [2010]. ISBN-13: 978-0-321-550071.
3. Madsen, Eugene L. Environmental microbiology [2008].ISBN-13: 978-1-4051-3647-1.
4. Talaro, Kathleen P. Foundations in microbiology. 8th edition [2012]. ISBN 978-0-07-337529-8.

Lecturer Yernazarova A.K.