**Al-Farabi Kazakh National University**

**Faculty of Biology and Biotechnology**

**Department of Molecular Biology and Genetics**

**Final exam program by discipline**

OB2202 "Objects of Biotechnology"

Educational program in the specialty “6B050103-Biotechnology, NIS”

Students, 2 course, 3 semester 2021-2022 academic year

**2021 y.**

The program of the final exam of the discipline OB2202 "Objects of Biotechnology" of the specialty “6B050103-Biotechnology, NIS” was compiled by Amirova Aigul Kuzembaevna, candidate of biological sciences, (Department of Molecular Biology and Genetics), Turasheva Svetlana Kazbekovna PhD, Associated Professor, Izmukan Azamat Zholdasuly, Master of BT (Department of Biotechnology).

Reviewed and approved at a meeting of the Department of Molecular Biology and Genetics

From "20" October 2021, protocol No. 5

Head of Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Zhunusbaeva Zh.K.

**The form of the final exam on the discipline** – Testing through the SDO Moodle

**The purpose of the assignment** is to assess the students' knowledge and understanding of the topics covered in this discipline; to recreate the conditions under which they will be able to assess the problem, analyze ways to solve the problem and apply the knowledge gained in practice; Test their ability to reason for their answers.

**Proctoring** – yes

**Type of options -** tests.

**Attempt** - 1

**Time to test** **-** 60 minute

**Types of questions in 1 test set:** multiple choice, true and false, insert the missing word, short answers and etc.

**Evaluation criteria:** Total - 100 points, each test – 1-3 points.

A (90-100%) - the student carefully studied the educational material; consistently and comprehensively answers the questions posed; freely applies the acquired knowledge in practice.

B (75-89%) - the student knows the educational material; does not make serious mistakes when answering; he can apply the acquired knowledge in practice.

С (60-74%) - the student knows only the basic material, does not always give an answer clearly and completely.

D (50-59%) - the student has separate ideas about the material being studied; cannot fully and correctly answer the questions posed, when answering, he makes gross mistakes.

**Exam questions**

**Block I**

1. Microbial Biotechnology: fundamentals of applied microbiology.

2. Prokaryotic Cells in Biotech Production. Fermentation Biotechnology.

3. Sterilization in Biotechnology. Types of sterilization.

4. Bioreactors, fermentation systems and metabolic pathways. Inoculum,

5. Production Media and Biomass Production in Microbial Biotechnology.

6. Isolation of End Masses as Fermentation Products.

7. Process management in Microbial Biotechnology: Genome management and analysis in Microbial Biotechnology.

8. Measurement, monitoring, modelling and control in Microbial Biotechnology.

9. Regulatory Issues in Biotechnology: Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP). Biosafety Guidelines and Regulations.

10. Downstream Processing.

**Block II**

1. Artificial conditions for cultivation plant cells

2. Ways of plant cells morphogenesis in vitro

3. Suspension culture: the advantage, methods of the receiving and cultivation

4. The use of cell culture for industrial production of biomass and BAS

5. The Stages of the Cellular technologies for production secondary metabolites

6. Immobilized cells: ways of receiving and advantage

7. Clonal micropropagation of plants and its advantages

8. Methods of clonal micropropagation technology of plants

9. Factors affecting on the process of plant micropropagation

10. The use micropropagation technology of plants and its prospects

11. The culture of apical meristems

12. Methods of diagnosis of infected plants

13. Obtaining virus-free planting material

14. Method of cell engineering. Theoretical and practical value of cell engineering

15. Methods of isolating protoplasts.

16. Method cultivation of protoplast in vitro

17. Protoplast fusion techniques. Plant regeneration from cultivated protoplasts

18. Somatic hybridization: advantages and disadvantages

19. Cell selection

20. Methods of cell selection

21. Genetic basis of somatic hybridization

22. The use of somatic hybridization in plant breeding

23. Methods for analysis of hybrid plants

24. Haploid technology

25. Androgenesis Methods

26. Ginogenesis method

27. Genetic Engineering. Current status and prospects of modern genetic engineering

28. Vector systems used for plant transformation

29. Methods of gene transfer into genome of plants

30. Cryoconservation techniques for Plant cells

**Block III**

1. Basic methods of animal biotechnology. Objects of Animal biotechnology. The structure of an animal cell. Achievements of animal biotechnology in the world and in Kazakhstan.

2. The main directions of animal breeding. Animal reproduction. Reproductive technologies: Artificial insemination. In vitro production of embryos. Embryo transfer.

3. The features of the organization of biotechnological laboratory in animal husbandry. Aseptic Techniques. Animal cell technologies. Mammalian cell and tissues culture and medium.

4. Biotechnology and genetic engineering of mammals. Fundamentals of Bioethics. Biosecurity.

5. Applications of Animal biotechnology. Animal Biotechnology economic implications. Regulation of the reproduction of farm animals.

**REFERENCES AND RESOURCES**

**Main:**

1. Reinhard Renneberg. Biotechnology for Beginners [2007]. ISBN: 9780123735812.
2. Gladys Alexandre and etc. Advances in applied microbiology [2009]. ISBN: 978-0-12-374788-4
3. Gareth Price. Biology: An Illustrated Guide to Science [2006]. ISBN-10: 0-8160-6162-9
4. John Wiley & Sons Ltd. Dictionary of Microbiology and Molecular Biology, Third Edition [2006]. ISBN-13 978-0-470-03545-0
5. Moselio Schaechter. Encyclopedia of microbiology. Third edition [2009]. ISBN*:* 9780123749802
6. Talaro-Talaro: Foundations in Microbiology, Fourth Edition [2011]. ISBN: 978-0072320428
7. Turasheva S.K. Basics of Biotechnology: Plant Biotechnology. Textbook. Almaty. 2016. -198 p.
8. R. Renaville and A. Burny (eds.), Biotechnology in Animal Husbandry, 2001. Kluwer Academic Publishers. Printed in the Netherlands. P. 209-223.
9. Lodish H, Berk A, Zipursky SL, et al. Molecular Cell Biology. 4th edition. New York: ed. by W. H. Freeman; 2000.
10. B.R. Glick & J.J. Pasternak. Molecular Biotechnology - Principles and Applications of Recombinant DNA. 3rd Edition). 2003
11. I.R. Gordon. Reproductive Technologies in Farm Animals. 2004. DOI 10.1079/9780851998626.0000
12. Animal Biotechnology. Technologies, Markets & Companies – Edited by Prof. K.K. Jain. Jain PharmaBiotech. A Jain Pharma Biotech Report. 2013. 215 p.

**Additional:**

1. Eugene W. Nester and etc. Microbiology: a human perspective, sixth edition [2011]. ISBN 978–0–07–299543–5
2. Prescott, Harley, and Klein’s microbiology, seventh edition [2008]. ISBN 978–0–07–299291–5
3. Nathan S. Mosier, Michael R. Ladisch. Modern biotechnology: connecting innovations in microbiology and biochemistry to engineering fundamentals [2009]. ISBN 978-0-470-11485-8
4. Tortora, Gerard J. Microbiology: an introduction [2010]. ISBN-13: 978-0-321-55007-1
5. Madsen, Eugene L. Environmental microbiology [2008].ISBN-13: 978-1-4051-3647-1
6. Talaro, Kathleen P. Foundations in microbiology. 8th edition [2012]. ISBN 978-0-07-337529-8.
7. Turasheva S.K. et al. Study guide for students' independent work on discipline "Basics of biotechnology: plant biotechnology." -Almaty: Kazakh University, 2014. - 258 p. ISBN 978-601-04-0692-6 (Турашева С.К. и др. Учебно-методическое пособие для самостоятельной работы студентов по дисциплине "Основы биотехнологии: биотехнология растений". -Алматы: Қазақ университеті, 2014. - 258 с. ISBN 978-601-04-0692-6)

**Internet resources:**

<https://www.goodreads.com/>

<https://www.coursera.org/>

<https://www.edx.org/>

<https://ed.ted.com/>

<https://www.ncbi.nlm.nih.gov/books/NBK207576/>

<https://stemcells.nih.gov/info/basics/4.htm>

<https://www.researchgate.net/figure/8551939>

<https://www.alpfmedical.info/situ-hybridization/organ-culture-in-the-analysis-of-tissue-interactions.html>

<https://en.wikibooks.org/wiki/Anatomy_and_Physiology_of_Animals/Reproductive_System>

[*http://people.ucalgary.ca/~browder/transgenic.html*](http://people.ucalgary.ca/~browder/transgenic.html)

<https://www.ncbi.nlm.nih.gov/books/NBK207576/>