**Al-Farabi Kazakh National University**

**Faculty of Biology and Biotechnology**

**Department of Molecular Biology and Genetics**

**Final exam program by discipline**

SPGR 7303 " Modern problems of Plant Genetics"

Educational program in the specialty 8D05101 "Genetics"

Doctor’s degree 1 year, 1 semester

**Almaty**

The program of the final exam of the discipline SPGR 7303 "Modern problems of Plant Genetics" of the specialty "8D05101 - Genetics" was compiled by Amirova Aigul Kuzembaevna Ph.D.

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

From "\_\_\_" \_\_\_ 2023, protocol No. \_\_

Head of the Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Zhunusbayeva Zh.K.

**The form of the final exam on the discipline** – written, offline, “Univer”.

**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.

**Type of options -** tickets.

There will be 3 questions on the ticket.

**Time to exam** **-** 2 hours.

**Evaluation criteria:** Block I - 30 points, Block II - 30 points, Block III - 40 points.

The first block includes questions of cognitive (knowledge) competence, which assess the knowledge and understanding of the object of study. This task allows you to demonstrate knowledge in the field of the genetic foundations of biotechnology, achievements and prospects for the development of biotechnology and genetic engineering, practical significance in various fields of science, production and industry, based on modern advanced textbooks, manuals and other literary sources. Valued at 30 points.

The second block includes questions that reveal functional competence, which assess the ability to apply, analyze information and systematize the results of scientific research by processing literature data. This task is aimed at identifying the ability to apply their knowledge, formulate and justify arguments and solve problems within the field of study. Valued at 30 points.

The third block includes questions of systemic competence, which reveal the ability to synthesize and evaluate information. This question is an applied task related to the use of biotechnological methods, which are aimed at testing practical skills.

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. Modern problems of plant genetics.

2. High-quality reference genome sequences.

3. Challenging Features of Plant Genomes.

4. Major achievements in plant pan-genomics.

5. In vitro culture and plant breeding.

6. Pollen and Microspore culture in Plant Improvement.

7. Creation of Haploid and Doubled haploid plants.

8. Recent applications of plant cell culture technology in the breeding process.

9. Aspects of Somatic Hybridization.

10. Genetic Resources, Chromosome Engineering, and Crop Improvement.

11. Chromosome Engineering.

**Block II**

1. Chromosome Engineering and Crop Improvement.

2. Genetic transformation of plants with Agrobacterium tumefaciens.

3. Agrobacterium-mediated plant transformation.

4. Method of biolistic transformation of plants.

5. Particle bombardment method.

6. Risks of modern biotechnologies and legal aspects of their implementation in agriculture.

7. Main problems of food safety.

8. Plant genome analysis. Pan-genome of plants.

9. Recombinant DNA technology.

10. The tools of recombinant DNA technology.

11. Methods of genetic transformation of plants.

12. Genetic transformation of plants.

**Block III**

1. The plant microbiome: ecology, functions, and emerging trends in microbial application.

2. Plant microbiota and their interactions.

3. From Sanger Technology to NGS: Getting Plants of the Ground.

4. NGS is tightly bound to bioinformatics.

5. The plant microbiome. NGS.

6. Impact of Genetic engineering in agriculture: zero hunger, achieving food security and nutrition and promoting sustainable agriculture.

7. Effect of abiotic and biotic stresses on food production.

8. Risk and safety assessment of genetically modified plants.

9. Biosafety and regulation of genetically modified plants.

10. CRISPR/Cas Genome Editing and Precision Plant Breeding in Agriculture

11. Plant Genome Editing via CRISPR/Cas DNA.

**REFERENCES AND RESOURCES**

**Literature:**

*Main:*

1. Шулембаева К.К., Токубаева А.А. Реконструкция генома мягкой пшеницы на основе хромосомной инженерии и отделенной гибридизации: монография. КазНУ им. аль-Фараби. - Алматы : Қазақ ун-ті, 2019. - 240 с.

2. Огурцов А.Н., Близнюк О.Н., Масалитина Н.Ю. Основы генной инженерии и биоинженерии. Учебное пособие. Часть 1.: Молекулярные основы генных технологий. Харьков: НТУ "ХПИ", 2018. - 288 с.

*Additional:*

1. Нефедова Л.Н., Применение молекулярных методов исследования в генетике: Учебное пособие. - М.: НИЦ Инфра-М, 2012. - 104 с.

2. Муминов Т.А., Куандыков Е.У. Основы молекулярной биологии : курс лекций. - Алматы : ССК, 2017. – 222 с.

3.Varshney Rajeev K. Plant Genetics and Molecular Biology. - London: Springer, 2018. - 298 p.

4. Halford Nigel G. Crop Biotechnology: Genetic Modification And Genome Editing. - London: World Scientific, 2018. - 218 p.

5. Glick Bernard R. Molecular biotechnology: principles and applications of recombinant DNA. - 4th ed. - Washington, 2010. - 1200 p.

**Professional scientific databases**

1. https://vc.ru/future/109057-gennaya-inzheneriya-sostoyanie-na-2020

2. https://sites.google.com/site/anogurtsov/lectures/ge2.

**Internet resources (at least 3-5)**

1. http://elibrary.kaznu.kz/ru

2. MOOC / video lectures, etc.

3. https://www.isaaa.org/resources/publications/pocketk/16/

4. https://www.goodreads.com/

5. https://www.coursera.org/