**Al-Farabi Kazakh National University Faculty of Biology and Biotechnology Department of Biotechnology**

**FINAL EXAM PROGRAM**

**SB 2208 STATISTICS IN BIOENGINEERING**

**6B05101 Biological Engineering**

**2024**

# Final Exam Program for “Statistics in bioengineering” course is designed for 3rd year students of ‘6B05101 Biological Engineering**’** specialty by Sandybayeva S.K., senior lecturer.

Head of Department Kistaubaeva A.S.

## BASIC INFORMATION ABOUT FINAL EXAM

**Final Exam form** – written form, offline

The **aim of testing** is to assess the ability of students to independently apply their knowledge when solving test tasks with multiple answers; the level of formation of analytical, research skills in discipline and creative thinking

**The examination is monitored** by the teacher.

**Date of exam** – by schedule

## The student must:

1. It is not allowed to enter the lecture hall for the exam after 20 minutes from the time specified in the schedule!
2. To put all personal belongings in a special place in the lecture hall;
3. Must have: a pen, a test book or a personal wallet. In the absence of identity documents, the student will not be admitted to the exam! In the case of the participation of fake students in the exam, the student will be subject to disciplinary responsibility along with the fake student.
4. Sign the arrival sheet and go and sit at the place indicated on the arrival sheet;
5. Listen carefully to the instructions of the teacher on duty and follow them;
6. To receive the exam answer sheet from the teacher on duty;
7. If the student has written the answers to the exam questions before the end of the exam, inform the teacher on duty and leave the pharmacy after passing the answer sheet with the permission of the teacher on duty.

## PAY ATTENTION! Manual creation and issuance of tickets is prohibited in case of technical problems during display or generation of tickets in UNIVER System.

**Prohibited:**

To bring to the exam unauthorized auxiliary materials and tools (crib, mobile phones (on or off), and other auxiliary electronic structures, etc.);

To make noise, talk, get up and walk in the classroom without the permission of the teacher on duty;

Leaving the lecture hall where the exam is taking place without the permission of the teacher on duty, except for answering the questions of the exam ticket ahead of time.

## ACCORDING TO EXAMINATION RESULTS:

1. The examination commission and the teacher certify the participants of the examination.
2. Univer assigns points to the final inventory.
3. The time for marking the attestation list for the oral exam is 48 hours.

**PROGRAM OF DISCIPLINE**

During the preparation for the exam, it is necessary to repeat the main theoretical content of the course, terminology and methods.

## List of topics:

Introduction to basic biostatistics and research methodology field. Definition and scope of biostatistics. The role of statistics in biology and biotechnology. Key stages of statistical analysis

Types of Data: Qualitative vs. quantitative data. Discrete vs. continuous data. Measurement scales: nominal, ordinal, interval, ratio.

Descriptive Statistics - Measures of Central Tendency. Measures of Dispersion: Range, variance, and standard deviation. Calculation of variance and standard deviation. Interpretation of results

Introduction to Probability. Basic concepts of probability Types of events: independent, dependent, mutually exclusive. Probability rules and their applications. Probability Distributions. Introduction to normal, binomial, and Poisson distributions

Characteristics and applications of each distribution. Calculation of probabilities using binomial and Poisson distributions

Sampling and Sampling Distributions. Definition of sampling and its importance. Types of sampling methods. Central Limit Theorem and its significance

Confidence Intervals: Concept of confidence intervals and their interpretation. Calculation of confidence intervals for means and proportions. Understanding margin of error

Hypothesis Testing – Basics: Null and alternative hypotheses.Type I and Type II errors. P-values and significance levels (α). Hypothesis Testing for Means. One-sample t-test: assumptions and manual calculation. Two-sample t-test: independent and paired samples. Interpretation of test results

Chi-Square Tests: Chi-square test for independence. Assumptions and applications. Manual calculation using contingency tables

Analysis of Variance (ANOVA): Understanding ANOVA for comparing more than two groups. Assumptions of ANOVA. Manual calculation of F-statistic and interpretation

Correlation and Simple Linear Regression: Concept of correlation: Pearson’s and Spearman’s coefficients. Interpretation of correlation coefficients

Introduction to survival analysis in medical studies. Concepts: survival function, hazard function, censoring. Ethical Considerations in Biostatistics. Ethical issues in data collection and analysis. Informed consent and data privacy. Avoiding biases and misinterpretation of results

**Literature:**

1. M. Islam • A. Al-Shiha. Foundations of Biostatistics. 2018. Springer. eBook. [https://doi.org/10.1007/978-981-10-8627-4 / ISBN 978-981-10-8626-7](https://doi.org/10.1007/978-981-10-8627-4%20/%20ISBN%20978-981-10-8626-7).
2. Biostatistics - Open Learning Textbook.2023/ LibreTexts Project/ eBook
3. Wayne W. Daniel. Biostatistics. Foundation for Analysis in the Health Sciences/1995/ John Wiley & Sons. Inc.
4. Y. Singh. Fundamental of Research Methodology and Statistics. 2006 New Age International (P) Ltd. ISBN : 978-81-224-2418-8.
5. Basic Biostatistics & Research Methodology / Elena Raevschi, Olga Penina; Ministry of Health of the Republic of Moldova, Nicolae Testemitanu State University of Medicine and Pharmacy of the Republic of Moldova, Department Nicolae Testemitanu Social Medicine and Management. – 2nd ed. – Chişinău: CEP Medicina, 2023. – 141 p.
6. Myra L. Samuels. Statistics for the Life Sciences. Pearson Education Limited 2016, ISBN 10: 1-292-10181-4.

## Internet resources:

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

2. MOOC / video lectures, etc.

3. Google Scholar

4. Sciencedirect.com

**ASSESSMENT GUIDE FOR THE FINAL**

**Discipline:** Microbiology and virology **Form:** standard oral/offline **Platform:** UNIVER system

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| --- | --- | --- | --- | --- | --- |
| **Percent**  **Criteria** | **Descriptors** | | | | |
| **Excellent** | **Good** | **Satisfactory** | **Unsatisfactory** | |
| **90–100 %** | **70–89 %** | **50–69 %** | **25–49 %** | **0–24 %** |
| **1. Knowledge and understanding of the theoretical material of the discipline**  **Question 1-2** | The questions have been thoroughly answered, illustrated visual  examples where appropriate. The answers are presented in scientific language. All terms and concepts of the discipline are used correctly and disclosed correctly. | Answers to questions are not full, correct  conclusions are interspersed with incorrect ones. Content blocks  biological profile, necessary for full disclosure of the topic, is missing. | Answers to questions are not full, correct conclusions are interspersed with incorrect ones. Content blocks  biological profiles,  necessary for full disclosure of the topic, are missing.  The student is generally oriented in the topics of the training course, but has problems with the disclosure of specific issues. Makes serious  mistakes, can't correct them independently. | Answers do not correspond to the content of the questions. The key concepts of the course contained in the questions are interpreted incorrectly. | There are no answers to the questions; the student's ignorance or misunderstanding of most or the most important part of the study material is revealed. Violation of the rules of final control. |
| **2. Logical response, ability to find ability to find a cause-and- effect relationship**  **Question 1-2** | A complete, detailed answer to the question is given, the totality of conscious knowledge about the object is shown, the main provisions of the discipline are conclusively revealed; the answer shows a clear structure, a logical sequence that reflects the essence of the concepts, theories, and phenomena being revealed. The  student has a firm grasp of the material on the | A complete, but insufficiently consistent answer to  the question(s) posed is given, but at the same time the ability to identify essential and non-essential features and cause-and- effect relationships is demonstrated. The answer is logical and stated in scientific terms. The student has knowledge only of the basic material, but does not know  individual details and features, admits | The student is not able to independently identify essential and non-essential features and cause-and- effect relationships. The student knows only individual points related to the questions asked, has poor command of the conceptual apparatus, and violates the consistency in the presentation of the material. | Incorrectly applies the essential part of the discipline and makes significant factual errors. The student does not realize the connection of this concept, theory, phenomenon with other objects of the discipline. There are no conclusions, specificity and evidence of the presentation. | There is no answer to the question. |

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|  | given questions and presents it competently and consistently. | inaccuracies and has difficulty formulating definitions. |  |  |  |
| **3. Assessment and analysis of solution of proposed practical**  **task Question 3** | The practical task has been completed in full. There are no errors in logical reasoning. There may be one inaccuracy or misprint, which is not a consequence of ignorance or  misunderstanding of the training material. The student has shown the full scope of knowledge and skills in mastering the passed topics and applying them in practice. | The task is completed in full, but the justification of the solution steps is insufficient. One error or two or three mistakes are made. | More than one error or more than two or three mistakes are made. Inaccuracies in the calculations. | The work is incomplete. Sufficient errors are made. The work is not done independently. | No work is done at all. |

**Formula for calculating the final grade:** Final grade (FG) = (P1+P2+P3) / 3C, where P – points % by criterion, C – total number of criterion.

Example

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **№** | **Perce nt**  **Criterion** | **«Excellent»** | **«Good»** | **«Satisfactory»** | **«Unsatisfactory»** | |
| **90-100 %** | **70-89 %** | **50-69 %** | **25-49 %** | **0-24 %** |
| **1.** | **Criterion** 1 | 100 |  |  |  |  |
| **2.** | **Criterion** 2 |  | 75 |  |  |  |
| **3.** | **Criterion** 3 |  |  | 60 |  |  |
|  | **Total percent** | **100** | **75** | **60** |  | 100 + 75 + 60 = 235  **235 / 3 criteria = 78,3 Total percent = 78** |

**A point-rating letter system for assessing the educational achievements of students with their translation into a traditional grading scale and ECTS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Letter grade** | **Number grade** | **Points %** | **Traditional system assessment** |
| А | 4,0 | 95-100 | Excellent |
| А- | 3,67 | 90-94 |
| В+ | 3,33 | 85-89 | Good |
| В | 3,0 | 80-84 |
| В- | 2,67 | 75-79 |
| С+ | 2,33 | 70-74 |
| С | 2,0 | 65-69 | Satisfactory |
| С- | 1,67 | 60-64 |
| D+ | 1,33 | 55-59 |
| D | 1,0 | 50-54 |
| FX | 0,5 | 25-49 | Unsatisfactory |
| F | 0 | 0-24 |  |