**SYLLABUS**

**Fall semester 2023-2024 academic year**

**Educational program "6B05101 Biological Engeneering"**

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| **ID** **and name** **of course** | **Independent work** **of the student****(IWS)** | **Number of credits** | **General****number** **of credits** | **Independent work** **of the student****under the guidance** **of a teacher (IWST)** |
| **Lectures (L)** | **Practical classes (PC)** | **Lab. classes (LC)** |
| 1132, Genetics  | IWS, 5  | 30 | 0 | 60 | 9 | IWST, 7 |
| **ACADEMIC INFORMATION ABOUT THE COURSE** |
| **Learning Format** | **Cycle,****component** | **Lecture** **types** | **Types** **of practical classes** | **Form and platform final control** |
| *Offline* | B | Offline  | Offline  | Online test in Univer system |
| **Lecturer - (s)** | Djansugurova Leyla Bulatovna, PhD, Full Professor |
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| **ACADEMIC COURSE PRESENTATION** |
| **Purpose****of the course** | **Expected Learning Outcomes (LO) \***  | **Indicators of LO achievement (ID)** |
|  | 1. To demonstrate knowledge of the basic principles of genetics | 1.1. demonstrate ability to reproduce the main principles of genetics.  |
| 1.2. find essential information, analyze it, classify, and synthesize any scientific conclusions. |
| 2. To apply the main principles and methods used in genetics for scientific and personal purposes. | 2.1 explain the obtained results of experiments. |
| 2.2 process properly any experimental data. |
| 3. To evaluate scientific data critically to exclude any fake facts and conclusions. | 3.1 analyze obtained data according to current information. |
| 3.2 prognose any possible variants of the results.  |
| 4. To design an experiment and be able to modify it according to the main methods and principles used in genetics | 4.1 plan the experiment taking into account available information, and modify the experiment if it is necessary. |
| 4.2 use modern methods and tools for the experiment. |
| 5. To present the results both of theoretical and practical education | 5.1 create a presentation, a scientific report, or a thesis as a conclusion of the experiment.  |
| 5.2 be able to discuss the main advantages and disadvantages of the selected method of research. |
| **Prerequisites** | Biochemistry, Molecular Biology, Structure and properties of biopolymers |
| **Postrequisites** | Biostatistics |
| **Learning Resources** | **Literature:** main, additional. 1. Emery and Rimoin's. Principles and Practice of Medical Genetics and Genomics. Perinatal and Reproductive Genetics. Edited by Reed E. Pyeritz, Bruce R. Korf, Wayne W. Grody. Seventh edition. Ebook. English, Elsevier Academic Press, 2022
2. [Bahar Taneri](https://worldcat.org/search?q=au=%22Taneri%2C%20Bahar%22).  Human genetics and genomics: a practical guide. Wiley-VCH, Weinheim, Germany, 2020. 142 p.
3. William S Klug, Michael A Palladino, Michael R Cummings, Charlotte A Spencer. Concepts of Genetics. Global Edition 12th Edition. Pearson – 2019.
4. Matthew W. Hahn Molecular Population Genetics. Publisher:Sinauer Associates is an imprint of Oxford University Press; 1st edition. 2018. 352 pages

1. [McKinsey L. Goodenberger](https://worldcat.org/search?q=au=%22Goodenberger%2C%20McKinsey%20L.%22), [Brittany C. Thomas](https://worldcat.org/search?q=au=%22Thomas%2C%20Brittany%20C.%22), [Teresa Kruisselbrink](https://worldcat.org/search?q=au=%22Kruisselbrink%2C%20Teresa%22), Practical genetic counseling for the laboratory. [Oxford University Press](https://worldcat.org/search?q=au=%22Oxford%20University%20Press%22). 2017. 383 p.
2. Hartwell, Leland Hartwell, Michael Goldberg, LeRoy Hood, Charles Aquadro. Genetics: From Genes to Genomes. 5th edition. Publisher: McGraw-Hill Education (05.09.2014). Copyright: 2015
3. Anthony JF Griffiths, Susan R Wessler, Sean B Carroll, John Doebley. An Introduction to Genetic Analysis. 11th edition. Publisher: W. H. Freeman (12.01.2015) Copyright:2015

**Research infrastructure**1. According to the schedule2. Institute of Genetics and Physiology **Professional scientific databases**1. NCBI**Internet resources** 1. Genetics // Written by A.M. Winchester. Last Updated: 2023 [https://www.britannica.com/science/genetics](https://www.britannica.com/science/genetics/Microbial-genetics)2. Emery and Rimoin's Principles and Practice of Medical Genetics and Genomics. ELSEVIER ACADEMIC PRESS; 2021. https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=2929548. 2023.3. <https://www.amnh.org/explore/ology/genetics/what-is-genetics>4. Thompson & Thompson Genetics and Genomics in Medicine Elsevier eBook on VitalSource, 9th Edition by Ronald Cohn, Stephen Scherer and Ada Hamosh// ISBN: 9780323553308 Copyright: 2024 Page Count: 570 Imprint: Elsevier |

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| **Academic****course policy** | The academic policy of the course is determined by [the Academic Policy](https://univer.kaznu.kz/Content/instructions/%D0%90%D0%BA%D0%B0%D0%B4%D0%B5%D0%BC%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%B0%D1%8F%20%D0%BF%D0%BE%D0%BB%D0%B8%D1%82%D0%B8%D0%BA%D0%B0.pdf) and [the Policy of Academic Integrity of Al-Farabi Kazakh National University .](https://univer.kaznu.kz/Content/instructions/%D0%9F%D0%BE%D0%BB%D0%B8%D1%82%D0%B8%D0%BA%D0%B0%20%D0%B0%D0%BA%D0%B0%D0%B4%D0%B5%D0%BC%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%BE%D0%B9%20%D1%87%D0%B5%D1%81%D1%82%D0%BD%D0%BE%D1%81%D1%82%D0%B8.pdf) Documents are available on the main page of IS Univer .**Integration of science and education.** The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions andassignments.**Attendance.** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points.**Аcademic honesty.** Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable.Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by [the "Rules for the final control"](https://univer.kaznu.kz/Content/instructions/%D0%9F%D1%80%D0%B0%D0%B2%D0%B8%D0%BB%D0%B0%20%D0%BF%D1%80%D0%BE%D0%B2%D0%B5%D0%B4%D0%B5%D0%BD%D0%B8%D1%8F%20%D0%B8%D1%82%D0%BE%D0%B3%D0%BE%D0%B2%D0%BE%D0%B3%D0%BE%20%D0%BA%D0%BE%D0%BD%D1%82%D1%80%D0%BE%D0%BB%D1%8F%20%D0%9B%D0%AD%D0%A1%202022-2023%20%D1%83%D1%87%D0%B3%D0%BE%D0%B4%20%D1%80%D1%83%D1%81%D1%8F%D0%B7%D1%8B%D0%BA%D0%B5.pdf) , ["Instructions for the final control of the autumn / spring semester of the current academic year"](https://univer.kaznu.kz/Content/instructions/%D0%98%D0%BD%D1%81%D1%82%D1%80%D1%83%D0%BA%D1%86%D0%B8%D1%8F%20%D0%B4%D0%BB%D1%8F%20%D0%B8%D1%82%D0%BE%D0%B3%D0%BE%D0%B2%D0%BE%D0%B3%D0%BE%20%D0%BA%D0%BE%D0%BD%D1%82%D1%80%D0%BE%D0%BB%D1%8F%20%D0%B2%D0%B5%D1%81%D0%B5%D0%BD%D0%BD%D0%B5%D0%B3%D0%BE%20%D1%81%D0%B5%D0%BC%D0%B5%D1%81%D1%82%D1%80%D0%B0%202022-2023.pdf) , "Regulations on checking students' text documents for borrowings".Documents are available on the main page of IS Univer .**Basic principles of inclusive education.** The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life.All students, especially those with disabilities, can receive counseling assistance by phone / e- mail (*87786651836, Lebedeva L.P.)* or via video link in MS Teams *(https://meet.google.com/ttu-eqcr-rdt)***Integration MOOC (massive open online course).** In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule. **ATTENTION!** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points. |
| **INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT** |
| **Score-rating letter system of assessment of accounting for educational achievements** | **Assessment Methods** |
| **Grade** | **Digital****equivalent****points** | **points,****% content** | **Assessment according to the traditional system** | **Criteria-based assessment** is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.**Formative assessment is** a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.**Summative assessment** -type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course.Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated. |
| A | 4.0 \_ | 95-100 | Great |
| A- | 3.67 | 90-94 |
| B+ | 3.33 | 85-89 | Fine |
| B | 3.0 | 80-84 | **Formative and summative assessment** | **Points % content** |
| B- | 2.67 | 75-79 | Activity at lectures | 7 |
| C+ | 2.33 | 70-74 | Work in practical classes | 33 |
| C | 2.0 | 65-69 | Satisfactorily | Independent work | 60 |
| C- | 1.67 | 60-64 | Design and creative activity |  |
| D+ | 1.33 | 55-59 | Unsatisfactory | Final control (exam) | 40 |
| D | 1.0 | 50-54 | TOTAL | 100 |
| **Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.** |

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| **A week** | **Topic name** | **Number of hours** | **Max.****ball** |
| **MODULE 1** **Introduction to Genetics** |
| **1** | **L 1.** Subjects and Methods of Genetics. Categories of heredity and variability. Branches of Genetics. Genetic objects. The history of Genetics. | 2 | **1** |
| **LC 1.** Model organisms used in Genetics. | 4 | **4** |
| **MODULE 2** **Principles of inheritance and the Mendelian genetics laws** |
| **2** | **L 2.** The basic genetic concepts. Genetic symbols. Monohybrid crossing. Mendel's laws for monohybrid crosses. The types of allelic genes interactions. | **2** | **1** |
| **LC 2.** Monohybrid crosses. Genetic problems and their practical usage | **4** | **4** |
| **3** | **L 3.** Di-and polyhybrid crosses. The third law of Mendel. Principles of inheritance of polyhybrid crosses. The cytological basis of Mendel's laws. The general formula for the independent inheritance splitting | **2** | **1** |
| **LC 3.** Dihybrid and polyhybrid crosses. Genetic problems and their practical usage | **4** | **4** |
| **IWS 1.** Tasks on monohybrid crosses |  | **25** |
| **MODULE 3****Inheritance and variability** |
| **4** | **L 4.** The interaction between nonallelic genes. The statistical nature of splitting. The chi-square test. Lethal genes. Modifier genes | **2** | **1** |
| **LC 4.** Allelic genes interactions. Complete dominance, incomplete dominance, codominance, and superdominance | **4** | **4** |
| **5** | **L 5.** Sex determination and sex-linked inheritance. Nondisjunction of sex chromosomes. Regulation of sex | **2** | **1** |
| **LC 5.** Non-allelic genes interactions. Epistasis, complimentary, polymerism, and pleiotrop1y | **4** | **4** |
| **IWS 2.** Tasks on dihybrid crosses |  | **20** |
| **6** | **L 6.** Linkage and crossing over. Genetic evidence of crossing over. The genetic mapping of chromosomes. Regulation of crossing over. Chromosome theory of heredity | **2** | **1** |
| **LC 6.** Crossing-over genetic problems and their practical usage | **4** | **4** |
| **IWST 1.** Tasks on interaction between nonallelic genes |  | **15** |
| **7** | **L 7.** Extra-nuclear inheritance. Mobile elements of the genome | **2** | **1** |
| **LC 7.** Chi-square method for analysis and its practical usage | **4** | **9** |
| **Midterm control 1** | **100** |
| **MODULE 4** **Variability of genetic material, molecular genetics view** |
| **8** | **L 8.** Hereditary and non-hereditary variability. Mutation theory of Hugo de Vries. Classification of mutations. Modifications and the rate of reaction. The Vavilov’s law of variability homologous series | **2** | **1** |
| **LC 8.** Hugo de Vries theory of mutagenesis. Somatic and sex-linked diseases. Genetic problems and their practical usage | **4** | **4** |
| **IWST 2.** Tasks on sex-linked inheritance |  | **15** |
| **9** | **L 9.** The molecular basis of heredity. DNA replication. The genetic code. Mechanisms of transcription. Translation mechanisms | **2** | **1** |
| **LC 9.** Molecular basis of inheritance. Model of DNA and RNA | **4** | **4** |
| **10** | **L 10.** DNA repair mechanisms and its significance in the mutation process | **2** | **1** |
| **LC 10.** Evolution of the gene understanding theories. The fine structure of the gene. Gene functions | **4** | **4** |
| **IWST 3.** Tasks on genetic linkage and crossingover |  | **20** |
| **11** | **L 11.** Genomic mutations. Chromosomal rearrangements. Gene mutations | **2** | **1** |
| **LC 11.** Pedigree analysis and its practical usage for detection diseases and abnormalities | **4** | **5** |
| **12** | **L12.** Spontaneous and induced mutagenesis. Methods of study and accounting of mutations. Physical factors of mutagenesis. Chemical mutagenesis. Biological factors of mutagenesis. | **2** | **1** |
| **LC 12.** t-Test for analysis and its practical usage | **4** | **5** |
| **IWST 4.** Tasks on molecular structure of genes. |  | **10** |
| **MODULE 5****Basics of population genetics and selection process** |
| **13** | **L 13.** Genetics of populations. Hardy-Weinberg Equilibrium. Factors influencing on population structure | **2** | **1** |
| **LC 13.** Hardy-Weinberg Equilibrium and its practical usage | **4** | **5** |
| **IWST 5.** Tasks on population genetics |  | **10** |
| **14** | **L 14.** Genetic methods of selection process. Types of selection. Inbreeding. Heterosis | **2** | **1** |
| **LC 14.** Types of selection process, breeding and its practical usage | **4** | **5** |
| **15** | **L 15.** Genetics of Human. Medical genetics. Modern methods of genetic engineering and gene editing. Clones and chimeras. | **2** | **1** |
| **LC 15.** Modern methods of gene engineering and their practical usage | **4** | **9** |
| **Midterm control 2** | **100** |
| **Final control (exam)** | **100** |
| **TOTAL for course** | **100** |

**Dean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kurmanbayeva M. S.**

**Head of Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Zhunusbayeva Zh. K.**

**Lecturer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Djansugurova L.B.**

**RUBRICATOR OF THE SUMMATIVE ASSESSMENT**

**CRITERIA EVALUATION OF LEARNING OUTCOMES**

Issued at the request of the teacher for each planned summative assessment (IWST)

**TEMPLATE**

**Task name** (points, % content from 100% MC, copy from the calendar (graphics) implementation of the content of the training course, methods of teaching and learning

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| --- | --- | --- | --- | --- |
| **Criterion**   | **"Excellent"**  **Max. weight in %**  | **"Good"**  **Max. weight in %**  | **"Satisfactory"**  **Max. weight in %**  | **"Unsatisfactory"**  **Max. weight in %**  |
|    |    |    |    |    |

**Example 1. Written assignment "My professional history" (25% of 100% MC)**

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| **Criterion**  | **"Excellent"**20-25% | **"Good"**15-20% | **"Satisfactory"**10-15% | **"Unsatisfactory"**0-10% |
| **Understanding Theories** **and concepts of professional identity and professionalism of a teacher**   | Deep understanding of theories, concepts of professional identity and teacher professionalism. Relevant and relevant links (citations) to key sources are provided.  | Understanding theories, concepts of professional identity and teacher professionalism. Links (citations) to key sources are provided.  | Limited understanding of theories, concepts of professional identity and teacher professionalism. Limited references (citations) to key sources are provided.  | Superficial understanding / lack of understanding of theories, concepts of professional identity and professionalism of the teacher. Relevant references (citations) to key sources are not provided.  |
| **Awareness of key issues of professional identity and professionalism of teachers in Kazakhstan**   | Links well the key concepts of professional identity and teacher professionalism with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).  | Links the concepts of professional identity and teacher professionalism with the context of Kazakhstan. Supports arguments with evidence from empirical research.  | Limited connection of the concepts of professional identity and professionalism of teachers with the context of Kazakhstan. Limited use of evidence from empirical research.  | There is little or no connection between the concepts of a teacher's professional identity and the context of Kazakhstan. Little or no use of empirical research.  |
| **Policy proposal or practical recommendations/suggestions**   | Offers sound policy and/or practical recommendations, proposals for improving the professional identity and professionalism of teachers in Kazakhstan.  | Offers some policy and/or practical recommendations, proposals for enhancing the professional identity and professionalism of teachers in Kazakhstan  | Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.  | Little or no policy and practice advice, or advice of very low quality.  |
| **Letter,**  **APA style**   | The writing demonstrates clarity, conciseness and correctness. Strictly follows the APA style.  | The letter demonstrates clarity, conciseness and correctness. Basically follows the APA style.  | The letter has some key errors and clarity needs to be improved. There are mistakes in following the APA style.  | The writing is unclear, it is difficult to follow the content. Lots of mistakes in following the APA style.  |

   **Example 2. Group presentation "Teaching profession in Kazakhstan" (30% of 100% RK)**

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| --- | --- | --- | --- | --- |
| **Criterion**  | **"Excellent"** 25-30% | **"Good"** 20-20% | **"Satisfactory"** 15-20% | **"Unsatisfactory"** 0 – 15% |
| **Understanding theories and concepts of the professional identity of the teacher and the teaching profession**   | Deep understanding of theories, concepts of the professional identity of the teacher and the teaching profession.  | Understanding theories, concepts of the professional identity of the teacher and the teaching profession.  | Limited understanding of theories, concepts of the professional identity of the teacher and the teaching profession.  | Superficial understanding / lack of understanding of theories, concepts of the professional identity of the teacher and the teaching profession.  |
| **Awareness of key issues of the professional identity of the teacher and the teaching profession in Kazakhstan**   | Competent correlation of the key concepts of the professional identity of the teacher and the teaching profession with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).  | There is a connection between the concepts of professional identity of a teacher and the teaching profession with the context of Kazakhstan. The arguments are backed by evidence from empirical research.  | Limited correlation of the professional identity of the teacher and the concepts of the teaching profession with the context of Kazakhstan. Limited use of evidence from empirical research  | Insignificant connection / lack of connection between the concepts of the teacher's professional identity and the context of Kazakhstan. Little or no empirical research is used.  |
| **Pilot Study**   | Excellent use of the results of pilot studies (interviews or surveys) in the presentation  | Good use of the results of pilot studies (interviews or surveys) in the presentation.  | Satisfactory use of the results of pilot studies (interviews or surveys) in the presentation.  | Poor use of the results of pilot studies (interviews or surveys) in the presentation.  |
| **Suggestion of policy or practical recommendations/suggestions**   | Offers very good policy and/or practical advice or suggestions for improving the professional identity and teaching profession in Kazakhstan.  | Offers some policy and/or practical recommendations or suggestions for improving the professional identity and teaching profession in Kazakhstan.  | Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.  | Little or no policy and practice advice, or advice of very low quality.  |
| **Presentation,** **teamwork**   | Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.  | Good engagement, good quality visuals, slides or other materials, good teamwork.  | Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.  | Low engagement, low quality content, poor teamwork.  |