**SYLLABUS**

**Fall semester 2021-2022 academic years**

**on the educational program “\_\_\_\_\_\_\_\_\_\_\_\_”**

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| **Discipline’s code** | **Discipline’s title** | **Independent work of students (IWS)** | **No. of hours per week** | | | | | **Number of credits** | **Independent work of student with teacher (IWST)** |
| **Lectures (L)** | **Practical training (PT)** | | **Laboratory (Lab)** | |
|  | Theoretical and computational problems of mathematical physics |  | 1 | 2 | | 0 | | 3 |  |
| **Academic course information** | | | | | | | | | |
| **Form of education** | **Type of course** | **Types of lectures** | | | **Types of practical training** | | **Number of IWS** | | **Form of final control** |
|  |  |  | | |  | |  | |  |
| Lecturer | S. Ya. Serovajsky, doctor of science, professor | | | | | |  | | |
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| **Academic presentation of the course** |

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| **Aim of course** | **Expected Learning Outcomes (LO)**  As a result of studying the discipline the undergraduate will be able to: | **Indicators of LO achievement (ID)**  (for each LO at least 2 indicators) |
| Give a logical construction of mathematics as a unified science. | LO1 Know the foundation of the architecture of mathematics | ID1.1 Language of mathematics  ID1.2 Notion of set |
| LO2 Know the foundation of the set theory | ID2.1 Correspondences and relations  ID2.2 Operator and equivalence |
| LO3 Know the definition of the general numerical classes | ID3.1 Cardinality numbers and solutions numbers  ID3.2 Real and complex numbers |
| LO4 Know the general classes of mathematical objects | ID4.1 Ordered objects  ID4.2 Algebraic objects  ID4.3 Topological objects  ID4.4 Measured objects |
| LO5 Know the idea of composite objects | ID5.1 Coordination of structures  ID5.2 Topological algebraic objects |
| LO6 Know the synthesis mathematical theories | ID6.1 Structures  ID6.2 Categories |
| **Prerequisites** | **Algebra, Analysis** | |
| **Post requisites** | Special courses | |
| **Information resources** | 1. S. Serovajsky. Architecture of Mathematics. – London, Chapman and Hall/CRC, 2020  2. С.Я. Серовайский Архитектура математики. – Алматы, Print-S, 2005.  3. M. Potter. Set Theory and Its Philosophy: A Critical Introduction. – Oxford University Press, 2004.  4. S. Mac Lane. Categories for the Working Mathematician. Graduate Texts in Mathematics.  Springer-Verlag, 1998.  5. H. Eves. Foundations and Fundamental Concepts of Mathematics. – Dover Publications, INC, Mineola NY, 1990.  6. Вейль Г. Математическое мышление. – М., Мысль, 1984.  7. Гелбаум Б., Олмстед Дж. Контрпримеры в анализе. – М., Наука, 1967.  8. <https://www.youtube.com/user/TheCatsters>  9. <https://plato.stanford.edu/entries/category-theory/>  10. <https://cpb-us-w2.wpmucdn.com/u.osu.edu/dist/1/1952/files/2014/01/fom12pt5.31.00-1jkl4df.pdf> | |

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| **Academic policy of the course in the context of university moral and ethical values** | **Academic Behavior Rules:**  All students have to register at the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the discipline study schedule.  ATTENTION! Non-compliance with deadlines leads to loss of points! The deadline of each task is indicated in the calendar (schedule) of implementation of the content of the curriculum, as well as in the MOOC.  **Academic values:**  - Practical trainings/laboratories, IWS should be independent, creative.  - Plagiarism, forgery, cheating at all stages of control are unacceptable.  - Students with disabilities can receive counseling at e-mail \*\*\*\*\*\*\*@gmail.com. |
| **Evaluation and attestation policy** | **Criteria-based evaluation:**  assessment of learning outcomes in relation to descriptors (verification of the formation of competencies in midterm control and exams).  **Summative evaluation:** assessment of work activity in an audience (at a webinar); assessment of the completed task. |

**CALENDAR (SCHEDULE) THE IMPLEMENTATION OF THE COURSE CONTENT:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| weeks | Topic name | LO | ID | amount of hours | Maximum score | Form of Knowledge Assessment | The  Form of the lesson  / platform |

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| **Module I. Introduction.** | | | | | | | |
| 1 | **L.1 Foundation of the architecture of mathematics**. Language of mathematics. Notion of set | LО 1 | ID 1.1., 1.2 | 1 | 5 |  | Video lecture  in MS Teams |
| 1 | **PT 1** Language of mathematics | LО 1 | ID 1.1. | 2 | 15 | Analysis | Webinar  in MS Teams |
| **Module П Set theory** | | | | | | | |
| 2 | **L.1 Foundation of the set theory** Correspondences and relations  ID2.2 Operators and equivalence | LО 2 | ID 2.1. | 1 | 5 |  | Video lecture  in MS Teams |
| 2 | **PT 1** Correspondences and relations | LО 2 | ID 2.1. | 2 | 15 |  | Webinar  in MS Teams |
| 3 | **L.2 Foundation of the set theory.** Operators and equivalence | LО 2 | ID 4.1. | 1 | 5 |  | Video lecture  in MS Teams |
| 3 | **PT 2** Operators and equivalence | LО 2 | ID 1.1. | 2 | 15 |  | Webinar  in MS Teams |
| **Module IП Numbers** | | | | | | | |
| 4 | **L.1 Cardinality numbers and solution numbers**  Natural, integer, rational, and algebraic numbers | LО 3 | ID 3.1. | 1 | 5 |  | Webinar  in MS Teams |
| 4 | **PT 1** Cardinality numbers and solutions numbers | LО 3 | ID 3.1. | 2 | 15 |  |  |
| 5 | **L.2 Real and complex numbers** | LО 3 | ID 3.2. | 1 | 5 |  |  |
| 5 | **PT 2** Real and complex numbers | LO 3 | ID 3.2. | 2 | 15 |  |  |
| 5 | **MT 1** | LО 1-3 |  |  | 100 |  |  |
| **Module IV Objects** | | | | | | | |
| 6 | **L.1 Ordered objects.** Differentordered sets | LО 4 | ID 4.1. | 1 | 5 |  | Video lecture  in MS Teams |
| 6 | **PT 1** Ordered objects | LО 4 | ID 4.1. | 2 | 15 | Analysis | Webinar  in MS Teams |
| 7 | **L.2 Algebraic objects**.Groupoids. Rings | LО 4 | ID 4.2. | 1 | 5 |  | Video lecture  in MS Teams |
| 7 | **PT 2** Groupoids. Rings | LО 4 | ID 4.2. | 2 | 15 | Analysis | Webinar  in MS Teams |
| 8 | **L.3 Algebraic objects**.Linear spaces. Abstract algebras | LО 4 | ID 4.2. | 1 | 5 |  | Video lecture  in MS Teams |
| 8 | **PT 3** Linear spaces. Abstract algebras | LО 4 | ID 4.2. | 2 | 15 | Analysis | Webinar  in MS Teams |
| 9 | **L.4 Topological objects**. Topological spaces | LО 4 | ID 4.3. | 1 | 5 |  | Video lecture  in MS Teams |
| 9 | **PT 4** Topological spaces | LО 4 | ID 4.3. | 2 | 15 | Analysis | Webinar  in MS Teams |
| 10 | **L.5 Topological objects**. Metric spaces | LО 4 | ID 4.3. | 1 | 5 |  | Video lecture  in MS Teams |
| 10 | **PT 5** Metric spaces | LО 4 | ID 4.3. | 2 | 15 | Analysis | Webinar  in MS Teams |
| 10 | **МТ (Midterm Exam)** | LО 4 | ID 4.1-4.3. |  | 100 |  |  |
| 11 | **L.6 Measurable objects.**Measures | LО 4 | ID 4.4. | 1 | 5 |  |  |
| 11 | **PT 6** Measures | LО 4 | ID 4.4. | 2 | 15 | Analysis | Video lecture  in MS Teams |
| 12 | **L.7 Measurable objects**. Integrals | LО 4 | ID 4.4. | 1 | 5 |  | Webinar  in MS Teams |
| 12 | **PT 7** Integrals | LО 4 | ID 4.4. | 2 | 15 | Analysis | Video lecture  in MS Teams |
| Module V. Composites | | | | | | | |
| 13 | **L.1 Composites.** Coordination of structures  Topological algebraic objects | LО 5 | ID 5.1,5.2 | 1 | 5 |  | Video lecture  in MS Teams |
| 13 | **PT 1** Topological algebraic objects | LО 5 | ID 5.1. | 2 | 15 | Analysis | Webinar  in MS Teams |
| Module VI. Synthesis | | | | | | | |
| 14 | **L.1** **Synthesis**. Structures | LО 6 | ID 6.1. | 1 | 5 |  | Video lecture  in MS Teams |
| 14 | **PT 1** Structures | LО 6 | ID 6.1. | 2 | 15 | Analysis | Webinar  in MS Teams |
| 15 | **L.2 Synthesis**. Categories | LО 6 | ID 6.2. | 1 | 5 |  | Video lecture  in MS Teams |
|  | **PT 2** Categories | LО 6 | ID 6.2. | 2 | 15 | Analysis | Webinar  in MS Teams |
|  | **MT 2** | LО 4-6 |  |  | 100 |  |  |

[Abbreviations: QS - questions for self-examination; TK - typical tasks; IT - individual tasks; CW - control work; MT - midterm.

Comments:

- Form of L and PT: webinar in MS Teams / Zoom (presentation of video materials for 10-15 minutes, then its discussion / consolidation in the form of a discussion / problem solving / ...)

- Form of carrying out the CW: webinar (at the end of the course, the students pass screenshots of the work to the monitor, he/she sends them to the teacher) / test in the Moodle DLS.

- All course materials (L, QS, TK, IT, etc.) see here (see Literature and Resources, p. 6).

- Tasks for the next week open after each deadline.

- CW assignments are given by the teacher at the beginning of the webinar.]

**Dean**

**Chairman of the Faculty Methodical Bureau**

**Head of the Department**

**Lecturer**