**SYLLABUS**

**Fall semester 2022-2023 academic years**

**on the educational program “……………… ”**

|  |  |  |  |  |  |  |  |  |  |
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| **Discipline’s code** | **Discipline’s title** | **Independent work of students (IWS)** | **Number of credits** | | | | | **Number of credits** | **Independent work of student with teacher (IWST)** |
| **Lectures (L)** | **Practical training (PT)** | | **Laboratory (Lab)** | |
|  | Mathematical analysis on metric spaces |  | 1 | 2 | | - | | 3 |  |
| **Academic course information** | | | | | | | | | |
| **Form of education** | **Type of course** | **Types of lectures** | | | **Types of practical training** | | **Number of IWS** | | **Form of final control** |
| Full-time |  |  | | |  | |
| Lecturer | Serovajsky Simon | | | | | |  | | |
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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. | 1. Know the foundation of the architecture of mathematics | 1.1 Language of mathematics  1.2 Notion of set |
| 2. Know the foundation of the set theory | 2.1 Correspondences and relations  2.2 Operator and equivalence |
| 3. Know the definition of the general numerical classes | 3.1 Cardinality numbers and solutions numbers  3.2 Real and complex numbers |
| 4. Know the general classes of mathematical objects | 4.1 Ordered objects  4.2 Algebraic objects  4.3 Topological objects  4.4 Measured objects |
| 5. Know the idea of composite objects | 5.1 Coordination of structures  5.2 Topological algebraic objects |
| 6. Know the synthesis mathematical theories | 6.1 Structures  6.2 Categories |
| **Prerequisites** | Algebra, Analysis | |
| **Post requisites** | Special courses | |
| **Information resources \*\*** | **Literature:\*\***  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.  **Internet resources:**  <https://www.youtube.com/user/TheCatsters>  <https://plato.stanford.edu/entries/category-theory/>  <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:**  **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.**ATTENTION!** Failure to meet deadlines results in loss of points! The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the training course, as well as in the MOOC. Leave in case of current MOOC or SPOC courses.  **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:**

|  |  |  |  |
| --- | --- | --- | --- |
| week | Topic name | Number of hours | Max.  score\*\*\* |
| **Module 1 Introduction** | | | |
| 1 | **Lec 1.** **Foundation of the architecture of mathematics**. Language of mathematics. Notion of set | 1 | 4 |
| 1 | **Sem 1.** Language of mathematics | 2 | 10 |
| **Module 2 Set theory** | | | |
| 2 | **Lec 2.** **Foundation of the set theory.** Correspondences and relations.  Operators and equivalence | 1 | 4 |
| 2 | **Sem 2.** Correspondences and relations | 2 | 10 |
| 3 | **Lec 3.** **Foundation of the set theory.** Operators and equivalence | 1 | 4 |
| 3 | **Sem 3.** Operators and equivalence | 2 | 10 |
| **Module 3. Numbers** | | | |
| 4 | **Lec 4. Cardinality numbers and solution numbers**  Natural, integer, rational, and algebraic numbers | 1 | 4 |
| 4 | **Sem 4.** Cardinality numbers and solutions numbers | 2 | 10 |
| 5 | **Lec 5 Real and complex numbers** | 1 | 4 |
| 5 | **Sem 5** Real and complex numbers | 2 | 10 |
| **Module 4. Optimization problems with isoperimetric conditions** | | | |
| 6 | **Lec 6 Ordered objects.** Differentordered sets | 1 | 4 |
| 6 | **Sem 6** Ordered objects | 2 | 10 |
| 7 | **Lec 7 Algebraic objects**.Groupoids. Rings | 1 | 6 |
| 7 | **Sem 7** Groupoids. Rings | 2 | 10 |
| **Midterm** |  |  | **100** |
|  |  |  |  |
| 8 | **Lec 8. Algebraic objects**.Linear spaces. Abstract algebras | 1 | 4 |
| 8 | Sem 8. Linear spaces. Abstract algebras | 2 | 9 |
| 9 | **Lec 9 Topological objects**. Topological spaces | 1 | 4 |
| 9 | **Sem. 9** Topological spaces | 2 | 9 |
| 10 | **Lec 10 Topological objects**. Metric spaces | 1 | 4 |
| 10 | **Sem 10.** Metric spaces | 2 | 9 |
| 11 | **Lec 11. Measurable objects.**Measures | 1 | 4 |
| 11 | **Sem 11.** Measures | 2 | 9 |
| 12 | **Lec. 12. Measurable objects**. Integrals | 1 | 4 |
| 12 | **Sem 12.** Integrals | 2 | 9 |
| **Module 5 Composites** | | | |
| 13 | **Lec 13. Composites.** Coordination of structures  Topological algebraic objects | 1 | 4 |
| 13 | Sem 13. Topological algebraic objects | 2 | 9 |
| **Module 6 Synthesis** | | | |
| 14 | **Lec** 14. **Synthesis**. Structures | 1 | 3 |
| 14 | **Sem 14** Structures | 2 | 9 |
| 15 | **Lec 15. Synthesis**. Categories | 1 | 3 |
| 15 | **Sem 15**. Categories | 2 | 9 |
|  | | | |
| **MT2** |  |  | **100** |
| **Exam** |  |  | **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 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Head of Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lecturer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTE:**

The total volume of the syllabus is no more than 5 pages, font 10, Times New Roman

\* LO is based on cognitive (1-2), functional (2-3), systemic (1-2) competencies, total 4-7.

The types and number of competencies (out of 5) are compiled according to the level of education.

\*\* Give no more than 5-7 sources of literature (full bibliographic description), in depth for the last 10 years. (in exceptional cases, 20-30% of irreplaceable classical textbooks), for natural directions - 10 years. Humanitarian direction -5 years

Literature and resources:

1. Basic literature

2. Additional reading

3. Software

4. Internet resources

5. Professional databases

\*\*\*Spreading the assessment of students' knowledge is at the discretion of the compilers of the syllabus.