**Syllabus***Fall semester, 2018-2019 Academic year*

Academic course information

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| Discipline’s code | Discipline’s title | Type | No. of hours per week | | | Number of credits | | ECTS |
| Lect. | Pract. | Lab. |
| SPTMPh 7326 | Modern problems of the theory of mathematical physics | MC | 2 | 1 | 0 | 3 | |  |
| Lecturer | S. Serovajsky | | | Office hours | | | Scheduled | |
| e-mail | [serovajskys@mail.ru](mailto:serovajskys@mail.ru) | | |
| Telephone number | +7 701 8315197 | | | Auditory | | | 312 | |

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| --- | --- |
| Academic presentation of the course | **Type of university**: The main purpose of the course is to familiarize students with the fundamental concepts of mathematical physics problems. Analysis of different forms of mathematical physics problems  **Aim of course:**  By the end the course, students should be able to:   1. To know the definitions of mathematical physics problems 2. To know the physical sense of mathematical physics problems 3. To know practical methods of finding the solutions of mathematical physics problems 4. To be able to substantiate the different forms of mathematical models 5. To know the relations between the different forms of mathematical models 6. To use the distributions for the analysis of mathematical physics problems |
| Prerequisites | Mathematical analysis, functional analysis |
| Post requisites | Differential equations, numerical methods |
| Information resources | **literature**:  1. Владимиров В.С. Обобщенные функции в математической физике. – М., Наука, 2009.  2. Тихонов А.Н., Самарский А.А. Уравнения математической физики. – М., Наука, 2008  3. Самарский А. А. Теория разностных схем. – М., Наука, 2007.  4. Антосик П., Микусинский Я., Сикорский P. Обобщенные функции. Секвенциальный подход. – М., Мир, 2006.  5. Серовайский С.Я. Секвенциальные модели математической физики. –  Алматы, Print-S, 2004.  6. Vladimirov V.S. Methods of the theory of generalized functions. Taylor & Francis, 2002.  7. Reed M., Simon B. Functional Analysis, N.Y., Academic Press 2000.  **Internet-resources:**  [http://www.newlibrary.ru/book/budylin\_a\_m\_/variacionnoe\_ischislenie.html](http://www.newlibrary.ru/book/budylin_a_m_/variacionnoe_ischislenie.html%20) . |
| Academic policy of the course in the context of university moral and ethical values | **Academic Behavior Rules:** Obligatory attendance of classes, intolerance for being late, commitment to deadlines for completion and delivery of assignments (CDS, Practical classes, midterm exams, individual projects).  **Academic values:** According to Article 5 of the Code of Honor of students of Al-Farabi Kazakh National University, a student must strictly fulfill his academic duties and prevent academic and legal violations (plagiarism, forgery, use of cribs, deceit of and disrespectful attitude to teaching stuff, absenteeism and coming late without respectful reasons).  All students can receive counseling assistance in person, by phone at the numbers indicated or by e-mail provided. |
| Evaluation and attestation policy | **Criteria-based evaluation:** evaluation of achieving learning outcomes in accordance with the descriptors (checking competencies acquired at weeks of the intermediate control, midterm and final examinations)  **Summative evaluation:**  Final score of the discipline =  IC1, IC2 are intermediate controls, МТ is Midterm, FE – final exam.  Percent-rating letter system for assessing of achievements of leaning outcomes by students:  95% - 100%: А 90% - 94%: А-  85% - 89%: В+ 80% - 84%: В 75% - 79%: В-  70% - 74%: С+ 65% - 69%: С 60% - 64%: С-  55% - 59%: D+ 50% - 54%: D- 0% -49%: F |

Calendar (schedule) the implementation of the course content**:**

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| --- | --- | --- | --- |
| **Week** | **Title** | **Hours** | **Max**  **score** |
| 1 | **Lecture 1.** Introduction into mathematical physics equations | 2 | 2 |
| **Seminar 1.** Determination of the heat equation and its classical solution. | 1 | 10 |
| 2 | **Lecture 2.** Approximation and convergence of the numerical method for the heat equation. | 2 | 2 |
| **Seminar 2.** Heat equation. Approximation methods | 1 | 10 |
| 3 | **Lecture 3**. Generalized functions. Generalized derivatives. Sobolev spaces | 2 | 2 |
| **Seminar 3.** Calculation of the generalized derivatives. | 1 | 7 |
| **IWST 1.** Calculation of the generalized derivatives. |  | 3 |
| 4 | **Lecture 4.** Generalized solution of the mathematical physics problems. Relations between classical and generalized solution. | 2 | 2 |
| **Seminar 4.** Relations between classical and generalized solution. | 1 | 10 |
| 5 | **Lecture 5.** Physical sense of the generalized solution of the stationary heat equation. Generalized model. | 2 | 2 |
| **Seminar 5.** Generalized solutions of the mathematical physics problems | 1 | 7 |
| **IWST 2.** Generalized solutions of the mathematical physics problems | 4 | 3 |
| 6 | **Lecture 6.** Approximation of the generalized model for the stationary heat equation. | 2 | 2 |
| **Seminar 6.** Approximation of the generalized model for the stationary heat equation. | 1 | 10 |
| 7 | **Lecture 7.** Convergence of the sequences and Cauchy principle. | 2 | 2 |
| **Seminar 7.** Proof of the convergence of sequences with using of Cauchy principle. | 1 | 6 |
| **IWST 3.** Proof of the convergence of sequences with using of Cauchy principle. | 4 | 20 |
| Border control 1 | |  | 100 |
| **Midterm** | |  | **100** |
| 8 | **Lecture 8.** Picard method and contracting mapping theorem. | 2 | 2 |
| **Seminar 8.** Solvability of algebraic equation and convergence of iterative method by contracting mapping theorem. | 1 | 8 |
| **9** | **Lecture 9.** Completeness of the spaces. Examples of incomplete spaces | 2 | 2 |
| **Seminar 9.** Examples of incomplete spaces | 1 | 5 |
| **IWST 4.** Examples of incomplete spaces | 4 | 3 |
| **10** | **Lecture 10.** Cantor’s definition of the set of real numbers. | 2 | 2 |
| **Seminar 10.** Applications of Cantor’s definition of the set of real numbers. | 1 | 8 |
| **11** | **Lecture 11.** Applications of the completion theorem. | 2 | 2 |
| **Seminar 11.** Completion theorem and its application. | 1 | 5 |
| **IWST 8.** Applications of the completion theorem. | 4 | 3 |
| **12** | **Lecture 12.** Sequential generalized functions theory | 2 | 2 |
| **Seminar 12.** Applications of the sequential generalized functions theory | 1 | 8 |
| **13** | **Lecture 13.** Sequentialextension of extremum problems. | 2 | 2 |
| **Seminar 13.** Sequentialextension of extremum problems. | 1 | 5 |
| **IWST 6.** Sequentialextension of extremum problems. | 4 | 3 |
| **14** | **Lecture 14.** Sequential models of mathematical physics problems. | 2 | 2 |
| **Seminar 14.** Sequential model of stationary heat transfer phenomenon. | 1 | 8 |
| **15** | **Lecture 15.** Sequential models of mathematical physics problems. | 2 | 2 |
| **Seminar 15.** Sequential model of stationary heat transfer phenomenon. | 1 | 8 |
| **IWST 7.** Sequential model of stationary heat transfer phenomenon. | 4 | 20 |
| Border control 2 | |  | **100** |
| **Final exam** | |  | **100** |
| **Total** | |  | **100** |

Lecturer S. Serovajsky

Head of the department of Kh. Khompysh

Chairman of the Faculty Methodical Bureau U.R.Kusherbayeva