NJSC « K. Zhubanov Aktobe Regional University»

Modular guide
on educational program
7M05401-Mathematics

Aktobe
2025

Module 1 – Basic Disciplines

Module Title	HPhS 5201 History and Philosophy of science (in Kazakh)
Semester(s) of Instruction	1
Instructor Responsible	Mukhambetkaliev E.E., Nurgaliev N.A.
Language of Instruction	Kazakh
Curriculum Association	University component (UC) in the cycle of basic disciplines (BD)
Modes of Instruction	Lectures, Practical lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 90 h. Contact hours: 30 h. (15 h.of lectures, 15 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 15h.of MSIWT, 45 h. of MSIW
ECTS	3
Prerequisites (Mandatory and Recommended)	To study the course "History and Philosophy of Science", a graduate student should have prior knowledge in the history and theory of philosophy, the humanities, the natural sciences, and relevant specialized disciplines.
Module Objectives / Expected Learning Outcomes	The purpose of teaching the discipline "History and Philosophy of Science" is to teach the structure of scientific knowledge, types and basic methods of scientific research, expand the worldview, explain the place of Science in the development of society. In particular, knowledge of the methods of modern science is one of the necessary tasks in the study of scientific creativity. In this regard, in order to improve their professional activities, the master's student must possess the knowledge of worldview, philosophical, cognitive, logical and methodological, as well as possess the skills of scientific research. As a result of full mastering of the discipline, the master's student can apply the knowledge gained in the professional field about the history and philosophy of the formation of science, including the structure and functions of scientific knowledge, methods of scientific research. At the same time, he knows the new directions of science that are emerging in modern scientific discourse, and for this purpose he can also have the ability to form new practices necessary for the development of domestic science.
Content	While studying the course "History and Philosophy of Science", a graduate student at a higher educational institution learns to fully master the culture of creative thinking as a future specialist and professional scientist. The student learns about the history and development of science, the role of philosophy in culture, and the methods and techniques of scientific inquiry. The student understands the trends in modern scientific development and the role of government policy in fostering new scientific disciplines. In addition, the main topics studied during the course help to shape the professional competence of young scientists.
Examination Format	Oral
Learning and Examination Requirements	Full mastery of the topics of the course, thorough engagement with the course literature, understanding the specifics of each topic along with its relevance, deep knowledge of the history of science, methods of scientific knowledge and scientific research.

List of literature	**Core Reading** 1. Kenny, A. *Ancient Philosophy*. Almaty: National Translation Bureau, 2018. – 364 pages. 2. Johnston, D. *A Brief History of Philosophy*. Almaty: National Translation Bureau, 2018. – 224 pages. 3. Kenny, E. *Medieval Philosophy*. Almaty: National Translation Bureau, 2018. – 352 pages. 4. Hess, R. *25 Landmark Books of Philosophy*. Almaty: National Translation Bureau, 2018. – 368 pages. 5. Ryskaliyev, T.Kh. *Overview of the History of Philosophy. Textbook*. Oral: Dastan, 2005. – 382 pages. 6. Abai. *Words of Edification. Poems*. Almaty, 1993. – 272 pages. 7. *World Philosophical Heritage*, Vol. 4: *Philosophy of Al-Farabi and Ibn Sina*. Almaty: Zhazushy, 2005. – 568 pages. 8. *Western Philosophy. Textbook*. Almaty: Zhazushy, 2009. – 480 pages. 9. Nysanbayev, A. *History and Philosophy of Science. Textbook*. Almaty: Evero Publishing, 2013. 10. Dyukenbayeva, Z.O., & Talgatbek, M.M. *Al-Farabi and Al-Mashani: Spiritual Continuity. Scientific Publication*. Almaty, 2017. 11. Abishev, K. *Philosophy: Textbook for Students and Master's Students*. Almaty, 2000. 12. Asarov, A. *Philosophy of Science: Terminological Dictionary*. Almaty: Medet Group, 2021. – 122 pages. **Supplementary Reading** 1. Al-Ani, N.M. *Philosophy of Technology*. St. Petersburg, 2004. 2. Gorokhov, V.G. *Fundamentals of the Philosophy of Technology and Technical Sciences*. Moscow, 2007. 3. *History of Informatics and the Philosophy of Information Reality*. Moscow, 2007. 4. Kazyutinsky, V.V. *Global Evolutionism and the Scientific Worldview*. In: *Global Evolutionism (Philosophical Analysis)*. Moscow, 1994. 5. Karamova, O.V. *Philosophy, Methodology, and History of Economic Science*. Moscow, 2007. 6. Kosichenko, A.G. *Scientific Creativity*. Almaty, 1992. 7. Kotenko, V.P. *History and Philosophy of Classical Science*. Moscow, 2005. 8. Lektorsky, V.A. *Classical and Non-Classical Epistemology*. Moscow, 2006. 9. Maidanov, A.S. *Methodology of Scientific Creativity*. Moscow, 2007. 10. *Mathematics and Experience: Collection of Articles*. Moscow, 2003. 11. Mukashev, Z.A. *Concepts of Modern Natural Science*. Almaty, 2005. 12. Nadtochaev, A.S. *Philosophy and Science in Antiquity*. Moscow, 1990. 13. Pechenkin, A.A. *Modern Philosophy of Science*. Moscow, 2005. 14. Rozin, V.M. *Methodology: Origins and Current State*. Moscow, 2006. 15. Rozin, V.M. *Thinking and Creativity*. Moscow, 2006. 16. Runge, V.F. *History of Design, Science, and Technology*. Moscow, 2006. 17. Svetlov, V.A. *History of the Scientific Method*. Moscow, 2007. 18. Feynman, R. *The Feynman Lectures: Six Easy Pieces and Six Not-So-Easy Pieces*. Moscow, 2006. 19. Filinova, O.E. *Mathematics in the History of World Culture*. Moscow, 2006. 20. Flowers, C. *The Ten Commandments of Instability*. Moscow, 2007. 21. Huntington, S. *The Clash of Civilizations*. Moscow, 2003. 22. Hawking, S., & Mlodinow, L. *A Briefer History of Time*. St. Petersburg, 2008. 23. Chernyak, V.Z. *History and Philosophy of Technology: A Guide for Postgraduates*. Moscow, 2006. 24. Shishkov, I.Z. *In Search of a New Rationality: The Philosophy of Critical Reason*. Moscow, 2003.

	25. Shchukarev, A.N. *Problems of Epistemology in Application to Natural Science and Its Methodological Development*. Moscow, 2007. **Electronic resources** Scientific libraries of Kazakhstan 1. National Electronic Library of Kazakhstan – http://www.kazneb.kz 2. National Academic Library – http://www.nabrk.kz 3. National Library of the Republic of Kazakhstan – http://www.nlrk.kz 4. Scientific Library of "Gylym Ordasy," Committee of Science, Ministry of Education and Science – http://www.library.kz 5. East Kazakhstan State University named after Sarsen Amanzholov – http://www.vkgu.kz 6. Karaganda State University named after E.A. Buketov – http://www.ksu.kz 7. Pavlodar State University named after S. Toraigyrov – http://www.psu.kz 8. South Kazakhstan State University named after M. Auezov – http://www.kazrena.kz Russian Scientific Electronic Libraries 1. Scientific Electronic Library – http://www.elibrary.ru 2. Russian Academy of Sciences, Institute of Philosophy Electronic Library – http://www.philosophy.ru/library/library.html 3. Russian Scientific Network – a public-access platform for scientific, popular science, and educational resources.

Module Title	FL(P) 5202 Foreign Language (professional)
Semester(s) of Instruction	1
Instructor Responsible	Erzhanova G.F.
Language of Instruction	English
Curriculum Association	University component (UC) in the cycle of basic disciplines (BD)
Modes of Instruction	Practical lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 90 h. Contact hours: 30 h. (30 h.of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 15h.of MSIWT, 45 h. of MSIW
ECTS	3
Prerequisites (Mandatory and Recommended)	English language (level B1)
Module Objectives / Expected Learning Outcomes	The main aim of the course is the formation of intercultural communicative competence of students, and as its component, professionally based intercultural communicative competence, which allows them to integrate into the international professional environment and use a professional foreign language as a means of intercultural, scientific and professional communication. 1. Ensures the socio-cultural aspects and national identity of the moral and ethical standards in relations of the countries where the language is taught; 2. Conducts bibliographic work, such as search, processing and analysis of information using modern technologies; 3. Processes of various information obtained from printed, audio and video sources in a foreign language within the framework of professional communication in accordance with the set goal; 4. Uses legal and ethical standards in assessing the consequences of their professional activities and in implementing socially significant projects; 5. Possesses the skills of independent use of information from printed and electronic sources on international relations and world politics in any field, other topics.

Content	The purpose of teaching English (professional) language is to enhance the linguistic, communicative, and sociocultural competencies acquired during previous stages of foreign language study. It aims to develop, on this foundation, the foreign professional communicative competence required by graduates for effective business and professional communication. The course covers a wide range of topics that are crucial for achieving advanced proficiency in speaking, reading, and writing in English, both in everyday situations and in the workplace.
Examination Format	Oral (examination cards)
Learning and Examination Requirements	The final assessment is conducted in an examination format. The examination is carried out in accordance with the university's academic integrity policy and examination regulations. The examination card includes three questions based on Bloom's taxonomy, with a total of 90 questions. If plagiarism or cheating is detected, the examination results will be canceled automatically, and the student will be required to retake the course in the midsummer term.
List of literature	**Core Reading** 1. Abdrakhmanova, T.M. *Professionally Oriented English: Educational and Methodological Guide*. – Almaty: CyberSmith, 2019. – 108 pages. https://elib.kz 2. Richard Harrison, Emma and Garry Pathare, Peter May. *Headway. Academic Skills. IELTS Study Skills Edition*. – Oxford: University Press, 2013. – 240 pages. https://ps.ua1lib.org/book/3297727/3df467?dsource=recommend 3. Aleshugina, E.A., Kryukova, G.K., Loshkareva, D.A. *Professionally Oriented English for Master's Students: A Textbook for Universities*. – Nizhny Novgorod: Nizhny Novgorod State University of Architecture and Civil Engineering, 2016. – 95 pages. ISBN 978-5-528-00113-5 https://pnu.edu.ru/ru/faculties/full_time/ffpmk/eng/e-lib 4. Kalinichenko, E.B. (compiler), Romanova, O.V. *English for Science: Educational and Methodological Guide for Master's Students*. – Saratov, 2016. – 75 pages. http://www.sgau.ru/files/pages/21056/14702970647.pdf **Supplementary Reading** 5. Oxenden, C., Latham-Koenig, C. *English File. Upper-Intermediate Student's Book. Level 4*. – Oxford: University Press, 2003. – 161 pages. **Electronic resources:** 6. Svetlana Ter-Minasova. Language and Intercultural Communication, 2018. – 320 pages. https://openu.kz 7. Ospanov, E.T. Academic Writing: A Study Guide. – Almaty, 2018. http://kazneb.kz 8. Tsai, N., Isina, G.I. Language and Intercultural Communication: Educational and Methodological Complex for Master's Students of the English Philology Program. – Karaganda: KarSU Publishing, 2009. – 45 pages. http://rmebrk.kz

Module Title	PHE 5203 Pedagogy of higher education (in English)
Semester(s) of Instruction	1
Instructor Responsible	Ramazanova D.J.
Language of Instruction	English
Curriculum Association	The university component (UC) in the cycle of basic disciplines (BD)
Modes of Instruction	Lectures, Practical lessons, MSIWT/ Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 90 h. Contact hours: 30 h. (15 h.of lectures, 15 h.of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 15h.of MSIWT, 45 h. of MSIW
ECTS	3
Prerequisites (Mandatory and Recommended)	The in-depth study of the 'Pedagogy' course at bachelor's level is based on prior professional knowledge, skills, and competencies acquired in philosophy, general pedagogy, and psychology.

Module Objectives / Expected Learning Outcomes	Familiarization of future teachers of vocational education with general problematics, methodological and theoretical foundations of higher school pedagogy, modern technologies of analysis, planning and organization of training and education, communicative technologies of subject interaction between teacher and student in the educational process of the University. A) knowledge and understanding of the role and place of Higher School pedagogy in the educational process of the University, the educational system of the University, laws and principles, content, forms, methods and techniques, tools, the result of the pedagogical process. B) the ability to possess practical skills of working with documentation that determines the content of training at the University, the ability to justify the goals of training, ways, methods and means of achieving the tasks and results of training. C) master the techniques of comparison, formulation and interpretation of conclusions, build your own arguments, develop your own views on the process of organizing training in vocational education. D) acquisition of practical skills in the field of communication, installation skills at certain stages of communication with other people during training. E) possession of practical skills in the field of vocational education, the ability to analyze the main problems in the management and management of the pedagogical process of the University.
Content	The essence and structure of the educational process, the purpose and content of higher professional education. Concepts, methods, means and organizational forms of training and education. The main categories and essence of pedagogical science. Theories of training and education in universities. Management of higher education institutions. Scientific activity in Higher School, Organization of research work of students. Monitoring and evaluation of learning outcomes. Modern pedagogical technologies. Improving the quality of higher professional education. Professional activity of a teacher.
Examination Format	Written work (essay)
Learning and Examination Requirements	Full mastery of the topics of the course, full familiarization with the literature during the course, understanding the specifics of each topic along with its relevance, deep knowledge of the history of science, methods of scientific knowledge and scientific research.

List of literature	**Core Reading** 1. Law of the Republic of Kazakhstan "On Education" (2007) with amendments as of 27.12.2019. 2. Bulakbayeva M.K. *Pedagogy of Higher Education: Textbook* / M.K. Bulakbayeva. - Almaty: Otan, 2015. - 208 pages. 3. Zhumataeva E. *Didactics of Higher Education: Textbook* / E. Zhumataeva. - Almaty: Epigraph, 2016. - 296 pages. 4. Zhumataeva E. *Theory of a Unified Didactic System of Teaching in Higher Education* / E. Zhumataeva. - Almaty: Epigraph, 2016. - 260 pages. 5. Sadykov T.S. *Didactic Foundations of Education in Higher Education* / T.S. Sadykov, A.E. Abilqassymova. - Almaty: Science, 2003. - 168 pages. 6. Sultangalieva T.V. *Preparation of Students for Continuous Pedagogical Practice: Methodological Guide* / T.V. Sultangalieva. - Aktobe: AGPI, 2009. - 236 pages. 7. *Methodological and Pedagogical Issues of Training Higher Education Teachers: Scientific and Practical Seminar Materials*. - Aktobe: [Publisher unknown], 2007. - 166 pages. 8. Nuryshyev, G.J. *Training a Qualified Specialist - The Main Task of Higher Education Institutions* / G.J. Nuryshyev. - Aktobe. - November 18, 2010. - p. 10. 9. *Searching for the Effective Model of Kazakhstani Universities: Monograph* / Chief Editor A.B. Kozhakhmetov. - Almaty: AlmaU Press, 2022. - 272 pages. 10. Myngbaeva, A.K. *Pedagogy of Higher Education: Textbook* / A.K. Myngbaeva, A.B. Aytbaeva, A.M. Kudaybergenova. - Almaty: Kazakh University, 2016. - 236 pages. 11. Tajibekova K.B. *Methodology of Teaching Economic Subjects: Textbook* / K.B. Tajibekova. - Almaty: Evero, 2018. - 112 pages. 12. Taubaeva Sh.T. *The Logic of Researching the Formation of Professional-Didactic Competence of Future Primary School Teachers* / Sh.T. Taubaeva. - Text: immediate. - *Scientific Work at School* - 2010. - Article No. 3. - pp. 2-8. 13. *Pedagogy of Higher Education: Textbook* / E.G. Skibitsky, V.V. Egorov, S.M. Udartseva, G.M. Smirnova, I.I. Erakhtina, V.V. Gotting. - Karaganda: KarMTU, 2013. - 412 pages. 14. Gromkova M.T. *Pedagogy of Higher Education: Textbook for Students*. – Moscow: Unity-Dana, 2013. – 447 pages. 15. Akhmetova G.K., Isaeva Z.A. *Pedagogy: Textbook for Master's Programs at Universities*. – Almaty: Kazakh University, 2006. - 328 pages. 16. Bashirov J.R. *Development of University Education in the Aspect of Teacher Training in Higher Education: Monograph* - Almaty: AMU, 2003. - 160 pages. 17. Myngbaeva A.K. *Fundamentals of Pedagogy in Higher Education: Textbook* - Almaty, 2010. - 171 pages. 18. Cohen, L., Manion, L. & Morrison, K. (2011). *Research Methods in Education* (7th ed.). 19. *Introduction to Educational Research: Theories, Methods, and Practices* - Monograph / Aida Sagyntaeyeva, Asel Kambatyrova, Laura Karabasova, Gulmira Kanai, Ajnur Almuqhametova. - Nur-Sultan: Nazarbayev University Graduate School of Education, 2022. – 232 pages. 20. *Developing Educational Programs: Local Responses to Global Challenges in Higher Education* - Monograph / Aida Sagyntaeyeva, Aizhan Musina, Aliya Suleymenova, Ruslan Karatabanov, Kairat Kuraqbaev, Duncan Priestly. - Nur-Sultan: Nazarbayev University Graduate School of Education, 2021. – 236 pages. 21. Igenbaeva R.T. *Pedagogy of Higher Education: Textbook*. – Almaty, 2011. – 169 pages. 22. Almetov N.Sh. *Pedagogy: Textbook* / N.Sh. Almetov, K.M. Arymbaeva. – Almaty: Evero Publishing, 2016. – 132 pages.

23. Abenbaev S. *Pedagogy: Textbook* / S. Abenbaev. - 2nd edition. - Astana: Foliant, 2015. - 284 pages.
24. Slambekova T.S. *Pedagogy: Textbook for Higher Education Students* (in three volumes). Volume 1: General Principles of Pedagogy. – Almaty: Evero, 2019.
25. Taubaeva Sh. *Pedagogical Methodology: Textbook* / Sh. Taubaeva. Karasay, 2013. – 432 pages.
26. Imzharova Z.U. *Active and Interactive Methods in Teaching Pedagogical Subjects: Methodological Recommendations* / Z.U. Imzharova. - Aktobe: K. Zhubanov Aktobe Regional University, 2015. – 67 pages.
27. Usmanov A.A., Sarsenbaeva M.B. *Pedagogy (Lecture Notes)*: Textbook for Students of Middle Vocational Education Institutions / A.A. Usmanov, M.B. Sarsenbaeva. – Almaty: Evero, 2017.

Supplementary Reading

1. Elen Bitam, Rona Sharp. *Revisiting Pedagogy in the Digital Age. Teaching Design in the 21st Century*. - Almaty: "National Translation Bureau" Public Foundation, 2019. - 328 pages.
2. Shunk Dale H. *The Theory of Teaching: Horizons of Education*. - Almaty: "National Translation Bureau" Public Foundation, 2019. - 608 pages.
3. *Myths, Legends, and Fairy Tales of Pedagogy* [Text]: Textbook. - V.K. Dyachenko, G.M. Kusaenov, A.K. Kagazbaeva, and others. - Almaty: TechSmith, 2019.
4. Togaybaeva, A.K. *Methodological Guidelines for Preparing Practical Sessions on the Subject "Fundamentals of Pedagogy" [Text]*: Methodological Tool / A.K. Togaybaeva, M.N. Esengulova. - Aktobe: K. Zhubanov Aktobe Regional University, 2018. - 52 pages.
5. *Current Issues in Pedagogy and Psychology*: Collection of Scientific Articles by Young Scholars / General Edit: B.Zh. Kurmanova, M.Yu. Sautenkova. In Kazakh, Russian, and English. - Aktobe: K. Zhubanov Aktobe Regional University, 2015. - 196 pages.

Electronic resources:

1. Shalgynbaeva, K.K. et al. Higher Education Pedagogy: A Textbook / K.K. Shalgynbaeva, N.P. Albytova, T.S. Slambekova. - Almaty: SSK, 2017. - 272 p. https://rmebrk.kz/book/1170382
2. Bitem, E. Rethinking Pedagogy in the Digital Age. 21st Century Teaching Design: A Textbook / E. Bitem. - Almaty: National Translation Bureau, 2019. - 328 p. https://rmebrk.kz/book/1171570
3. Mynbaeva, A.K. et al. Basics of Higher Education Pedagogy: A Textbook / A.K. Mynbaeva, A.B. Aitbaeva, A.M. Kudaybergenova. - Almaty: Kazakh University, 2016. - 236 p. https://rmebrk.kz/book/1175282
4. Akbaeva, L.K., Akbaeva, A.N. Pedagogy of Higher Education. Psychology of Higher Education: Methodological Guidelines for Seminar Sessions for Master's Students. - Almaty: KazGASA, 2012. - 49 p. https://rmebrk.kz/book/1105614
5. Nagymjanova, K.M. et al. The Current Global Higher Education System: A Collection of Lectures / K.M. Nagymjanova, R.K. Duysembinova, L.S. Kulzhabaeva. - Nur-Sultan: "Turán-Astana" University Press, 2019. - 138 p. https://rmebrk.kz/book/1179895
6. Jumataeva, E. Higher Education Didactics: A Monograph. - Pavlodar: EKO, 2006. - 316 p. https://rmebrk.kz/book/1165854
7. Jumataeva, E. The Application of Educational Technology in Higher Education. // S. Toraighyrov Pavlodar State University Bulletin. Pedagogical Series, 2008. - No. 1. https://rmebrk.kz/book/15206
8. Kasymbaeva, G.N. Optimal Approaches to Applying Interactive Teaching Methods in Higher Education. // The Role and Place of Young Scientists in the Dissemination of Kazakhstan's New Economic Policy: Proceedings of the International Sattbayev Readings. - Almaty: Kazakhstan, 2015. - Vol. 1. - Pp. 547-550. https://rmebrk.kz/book/1152143
9. School Pedagogy: Educational and Methodological Complex (Syllabus). / Comp. B.O. Kurbanaliev. - Zhetisay: Sirdariya University, 2007. - 120 p. https://rmebrk.kz/search/

	10. Kudebaeva, Z.N. Higher Education Pedagogy: Test Tasks: A Textbook. / Taraz State Pedagogical University. - Taraz: Format-Print, 2019. - 124 p. https://rmebrk.kz/search/ 11. Belykh, A.S. Pedagogy of Higher Education: A Textbook. - Lugansk: Publishing House of LNU named after V. Dal, 2018. - 248 p. http://dot.kostacademy.kz/bible/files/813849436.pdf 12. Mynbaeva, A.K. Basics of Pedagogy of Higher Education: A Textbook. - Almaty, 2008. - 144 p. https://www.researchgate.net/profile/AigerimMynbayeva/publication/311318161_Osnovy_pedagogiki_vyssej_skoly/links/584171c808ae8e63e6218359/Osnovy-pedagogiki-vyssej-skoly.pdf 13. Ostapenko, I.A. Pedagogy of Higher Education: A Textbook / I.A. Ostapenko, M.N. Krylova. - Zernograd: Azov-Black Sea Engineering Institute, Don State Agrarian University, 2017. - 177 p. https://xn--80aqa2d.xn--p1ai/files/2018-10-24-943c2c7f-8ebd-4751-a15c-b96b871b1b5b.pdf 14. Mandel, B.R. Pedagogy of Higher Education: History, Problems, Principles: A Textbook for Master's Students / B.R. Mandel. - Moscow; Berlin: Direct-Media, 2017. - 618 p. http://lab314.brsu.by/kmp-lite/kmp2/%D0%A1%D0%9F%D0%A2-2020/Mandel_Pedagogika-vyssheyshkoly.569935.pdf 15. https://www.scopus.com/authid/detail.uri?authorId=59165837400 16. https://www.scopus.com/authid/detail.uri?authorId=57218109272

Module Title	MP 5204 Management psychology (in Russian)
Semester(s) of Instruction	1
Instructor Responsible	Sautenkova M. Y.
Language of Instruction	Russian
Curriculum Association	University component (UC) in the cycle of basic disciplines (BD)
Modes of Instruction	Lectures, practical lessons, SIWT/Students' Independent Work with Teacher, SIW/Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total working hours: 90 hours Contact hours: 30 h. (15 h. of lectures, 15 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 15 h. of MSIWT, 15 h. of MSIW
ECTS	3
Prerequisites (Mandatory and Recommended)	General psychology, age psychology, psychodiagnostics
Module Objectives / Expected Learning Outcomes	This discipline addresses the problems of the applied field of psychological science, with a focus on the mandatory study and resolution of management-related issues at the national level, based on psychological knowledge and theories. Studying this discipline helps students master the psychology and culture of business communication and management activities, preparing them as future specialists in the educational environment.While mastering the discipline, special attention is given to the development of leadership, managerial, and reflective qualities in graduates pursuing educational management. This also involves their active participation in scientific activities, the development of leadership abilities, professional competencies, and other management methods, including: A) Understanding the essence and psychological characteristics of managerial functions; B) Conducting independent searches, critical analysis, systematization, and generalization; C) Managing teams and tolerating socio-psychological differences; D) Designing, implementing, and evaluating the educational process at universities, as well as the educational environment for training psychological professionals; E) Assessing the importance of self-development and self-realization in creative endeavors.

Content	The discipline examines the laws, principles, and methods of building and operating an organization; the laws and principles that govern the activities of managers in managing an organization; the role of managers in organizational management; and the individual (physiological, psychological, and social) requirements that a manager must meet.
Examination Format	Written (essay)
Learning and Examination Requirements	Complete mastery of the course topics, thorough familiarity with the relevant literature, understanding the specifics and relevance of each topic, and in-depth knowledge of the history of science, scientific methods, and research techniques.
List of literature	**Core Reading** 1. Konovalenko V. A., Konovalenko M. Yu., Solomatin A. A. Psychology of personnel management: a textbook for academic bachelor / V. A. Konovalenko, M. Yu. Konovalenko, A. A. Solomatin. — Moscow: Yurayt Publishing House, 2015. - 477 p. - (Series : Bachelor. Academic course). 2. Mambetalina A. S. HR-personnel management. Nur-Sultan, Gumilyov State University, 2021, 145c. 3. Maltseva Yu. A., Yatsenko O. Yu.. Psychology of management. Yekaterinburg: Ural Publishing House. 4. Alieva M. B., Magomedova E. E., Radzhabova R. V., Umarieva S. Z., Tsakhaeva A. A. Psikhologiya upravleniya [Psychology of management]. Training manual. Kiev, 2017. 5. Fundamentals of management: textbook /V. R. Vesnin. Moscow: Prospekt Publ., 2010, 97 p. 6. Psikhologiya upravleniya: Uchebnoe posobie [Psychology of Management: A textbook]. textbook: INFRA-M, 2011. - 249 p. http://znanium.com/bookread.php?book=313827 7. Psychology of personnel management: textbook and practical course for academic baccalaureate book. Adeut: Bazarov T. Yu., 2015; Moscow, Publishing house: Yurayt. - 381 p. 8. Volkogonova O. D., Zub A. T., Managerial psychology. Moscow FORUM Publishing House-INFRA-Moscow,2009. **Supplementary Reading** 9. Avdeev V. V., Personnel management. Optimization of team work: Reengineering technology: Practicum / V. V. Avdeev. - Moscow: FiS, 2008. - 256 p 10. Morozyuk S. N. Psychology of personality. Psychology of character: a textbook for universities/ S. N. Morozyuk. - Moscow: Yurayt Publishing House, 2024. - 217 p.- (Higher education). - ISBN 978-5-534-06609-8. / / Educational platform Yurayt [website]. - URL: https://urait.ru/bcode/540621 11. Ivanova V. S. Psikhologiya upravleniya [Psychology of management]. Training manual. Tomsk Polytechnic University Publishing House.2011. **Electronic resources:** 1. https: / / www. inter-nauka. com/uploads/public/15058901949362. pdf3. 2. Electronic library of dissertations of the RSL: http://diss.rsl.ru/. 3. LitRes Electronic Library: http://biblio.litres.ru.

Module Title	OPSR 5205 Organization and planning of scientific research (in English)
Semester(s) of Instruction	1
Instructor Responsible	Isimov A.m.
Language of Instruction	English
Curriculum Association	The university component (UC) in the cycle of basic disciplines (BD)
Modes of Instruction	Lectures, Practical lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work

Workload (Including Contact Hours and Independent Study)	Total hours: 90 h. Contact hours: 30 h. (**15 h. of lectures, 15** h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 15h.of MSIWT, 45 h. of MSIW
ECTS	3
Prerequisites (Mandatory and Recommended)	undergraduate subjects
Module Objectives / Expected Learning Outcomes	The purpose of studying the discipline is to familiarize the student with the basics of the formation of knowledge and skills in the field of planning and organizing scientific research, to teach the principles and methods of planning and conducting a scientific experiment. As a result of mastering the discipline, the novelty of research work, the quality and feasibility of research work, qualitative forecasting of the results of scientific research, scientific and technical, modern projects and works are formed. A) analyze the novelty, quality and feasibility of research work, qualitatively predict the results of research projects and works; B) form knowledge and skills in the field of planning and organizing scientific research, get acquainted with the principles and ways of conducting a scientific experiment; C) demonstrate, present ideas, research and apply in their professional activities knowledge and understanding based on advanced theories of their field in the context of research; D) critically analyzes, evaluates and synthesizes scientific theories in their field, relates to their own research; E) analyzes scientific information and draws up relevant results, competently formulates conclusions, conducts scientific research and research work.
Content	The content of the discipline includes the organization of scientific research, starting with a literary review, methods of searching for information, ending with the processing of research results and the formulation of conclusions. Scientific research methods, international databases, science measuring indicators, data processing methods, description of results, the structure of the master's thesis and its requirements are studied.
Examination Format	Blank test
Learning and Examination Requirements	Full mastery of the topics of the course, full familiarization with the literature during the course, understanding the specifics of each topic along with its relevance, deep knowledge of the history of science, methods of scientific knowledge and scientific research.

List of literature	**Core Reading:** 1. Dinaeva B.B., Sapina S.M. Theoretical and Practical Foundations of Academic Literacy. – Astana: "KazGYU Consulting" LLP, 2016. - 164 pages. 2. Isenova F.K. Educational and Methodological Guide for Studying the Discipline "Academic Writing and Reading" (Module 2 "Scientific Orientation"). – Astana: KazGYU University Press, 2015. - 144 pages. 3. Korotkina I. Academic Writing. Educational and Methodological Guide for School Principals and Education Specialists. Lap Lambert Academic Publishing GmbH and Co. Saabrucken, Germany, 2011. – P.179. 4. Radaev V.V. How to Organize and Present a Research Project: 75 Simple Rules. - Moscow: HSE, INFRA-M, 2001. - 202 pages. (Electronic version: http://narod.ru/disk/2882665000/radaev.rar.html) **Supplementary Reading:** 1. Butt U.K., Colomb G.D., Williams J.M. *Research: Sixteen Lessons for Beginning Authors* / Translated by A. Stanislavsky. - Moscow: Flinta: Nauka, 2004. - Pp. 51-90. (http://aperlov.narod.ru/ar/posobija.htm) 2. Eco U. *How to Write a Thesis. Humanities.* Educational and Methodological Guide / U. Eco. – Moscow: University, 2001. - 240 pages. (Electronic version: www.hcc.ru/download/ef7ecacfa0bc050dea6287f39c7aa566.attach) **Web – Resources and Support** 1. www.refseek.com 2. www.worldcat.com 3. https://link.springer.com 4. www.bioline.org.br 5. https://repec.org 6. www.science.gov 7. www.pdfdrive.com 8. www.base-search.net

Module 2.1. - Analysis and systems of partial differential equations

Module Title	MAMSA 5301 Mathematical analysis on manifolds and stochastic analysis (in Kazakh)
Semester(s) of Instruction	1
Instructor Responsible	Sartabanov Zh., Professor of the Department of Mathematics
Language of Instruction	Kazakh
Curriculum Association	Profile discipline (PD), university component (UC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Mathematical Analysis, Differential Equations, Differential Geometry, Probability Theory and Mathematical Statistics, Functional Analysis.
Module Objectives / Expected Learning Outcomes	The aim of the course is to significantly expand and deepen the content of such undergraduate courses as mathematical analysis, differential geometry, probability theory and to introduce the most important concepts for modern mathematics and the results of the expanded sections of the above-mentioned disciplines. Learning outcomes. Knowledge and understanding: Demonstrate knowledge and understanding of the modern concept of maps of multidimensional spaces, their differentials, differential forms and operations applied to them, manifolds in Euclidean spaces, the theory of random processes and the theory of stochastic calculus and Martingale theory. Application: Can apply knowledge, understanding and ability to solve problems in natural science, engineering, economics, industrial organization, communication theory, etc. Analysis: Analyze the results, integrate knowledge in solving problems of mathematical analysis on manifolds and stochastic analysis, and give an example of applications. Synthesis: Systematize knowledge in the discipline, develop methods for solving applied problems of mathematical analysis on manifolds and stochastic analysis. Assessment: Give an assessment of the application of the completed material in solving applied problems.
Content	This course examines mathematical analysis on manifolds and will consistently introduce students to modern concepts of maps of multidimensional spaces, their differentials, differential forms and operations used by them, and manifolds in Euclidean spaces. Next, an introduction to the theory of stochastic analysis is considered, it outlines the basic concepts of the theory of random processes and the theory of stochastic calculus, in particular, Ito's stochastic integral (with respect to the Wiener process) and the theory of martingales. The material considered in the course is related to the courses of mathematical analysis, differential geometry, probability theory and mathematical statistics and has a general character and can be applied in the course of their future scientific and practical activities.
Examination Format	Oral
Learning and Examination Requirements	The final assessment takes place in the format of an exam. The exam is conducted in accordance with the university's academic integrity policy and exam rules. If plagiarism or cheating is detected, the exam results are automatically canceled, and the discipline will be re-studied in the summer semester. Form of final control (exam): traditional (exam card-oral, tasks and examples). Exam questions in the discipline – 100. The ticket consists of two questions: the first question corresponds to the theoretical provisions, including the formulation of problems and methods of solution; the second question corresponds to the application (appendix). The results of the exam are entered by the teacher in an electronic form in the "Platonus" system.

List of literature	1. Ignatochkina L. A. Analysis on Manifolds, Moscow: Moscow State Pedagogical University, 2015, 211 pages. https://www.twirpx.com/file/2519855/ 2. Egorov A. I., Kashargin P. E. Differentiable Manifolds and Riemannian Geometry. Kazan: Kazan State University, 2010, 30 pages. https://www.twirpx.com/file/2052787 3. Zorich V. A. Mathematical Analysis. Part II. Moscow: ICNMO, 2017, 676 pages. http://math.uchicago.edu/~eskin/math203/Analiz%201%20(2012).pdf 4. Zhukovsky M. E., Rodionov I. V., Shabanov D. A. Fundamentals of the Theory of Random Processes. Moscow: MIPT, 2016, 121 pages. https://istina.msu.ru/download/43787921/1gH3jj:QEdAixNdehcfTxu0P4EH-7D0Pzc/ 5. Gasnikova A. V. Lectures on Random Processes, Moscow: MIPT, 2019, 254 pages. https://arxiv.org/pdf/1907.01060.pdf 6. Matalytskiy M. A. Probability Theory, Mathematical Statistics. Minsk: Higher School, 2017, 591 pages. https://vshph.com/upload/inf/978-985-06-2855-8.pdf 7. Bekareva N. D. Random Processes. Novosibirsk: NSTU Publishing House, 2016, 127 pages. http://library.kuzstu.ru/meto.php?n=233613.pdf&type=nstu:common 8. Nasyrov F. S. Local Times, Symmetric Integrals and Stochastic Analysis, Moscow: FIZMATLIT, 2011, 212 pages. https://www.twirpx.com/file/2421510 9. Monsik V. B., Skrynnikov A. A. Probability and Statistics. Ed. by Kabakbaev S. Zh. Almaty: MV-Print, 2012, 425 pages. http://rmebrk.kz 10. Galazhinskaya O. N., Moiseeva S. P. Theory of Random Processes. Tomsk: Publishing House of Tomsk State University, 2015. Part 1, 128 pages. https://b-ok.asia/book/2910538/9743eb?regionChanged=&redirect=22822140 11. Aukazhieva Zh. M. Theory of Mathematical Processing of Geodetic Measurements. Almaty: CyberSmith, 2017, 152 pages.

Module Title	GTSFOPDE 5206 General theory of the systems of first order partial derivative equations (in Russian)
Semester(s) of Instruction	2
Instructor Responsible	Abdikalikova G.A., Professor of the Department of Mathematics
Language of Instruction	Russian
Curriculum Association	Basic discipline (BD), elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	To master this module, you need knowledge, skills and abilities acquired while studying the following courses: Mathematical analysis on manifolds and Stochastic analysis; Differential equations, Mathematical physics and Numerical methods for their solution.

Module Objectives / Expected Learning Outcomes	The aim of the training is to deepen students' knowledge and familiarize graduate students with current problems in the general theory of first-order partial differential equation systems. It also aims to develop principles for constructing process models, demonstrate the potential of mathematics in justifying theoretical positions and solving practical problems, reveal connections with specialized disciplines, determine the role of differential equations in the scientific system, and foster both a scientific worldview and mathematical culture. A. Demonstrate knowledge and understanding of current issues in the general theory of first-order partial differential equations when conducting scientific research. B. Generate knowledge and new ideas in the context of scientific research on problems of differential equations and artificial intelligence, as well as understanding and ability to creatively apply research methods in constructing mathematical models of physical processes and finding solutions to corresponding problems of first-order partial differential equations. C. Integrate knowledge, formulate current problems of partial differential equations, develop principles for constructing a differential model of processes, on the basis of which the most rational strategy for solving problems is implemented. D. Communicate your knowledge, conclusions and ideas to the scientific community, justify the implementation and forecasting of research results in practice. E. Continue independent education in priority areas of natural sciences in the context of the growth of information and communication technologies.
Content	Statement of the problem of integration of partial differential equations in the case of two independent variables. Linear partial differential equation of the first order and the Cauchy problem. System of two simultaneous equations of the first order. The Pfaff equation and its geometric interpretation. Necessary and sufficient condition for integrability of the Pfaff equation. Types of integrals of partial differential equations. Geometric interpretation of integral types and characteristic lines. Lagrange-Charpy method. Cauchy method for two independent variables. Construction of an integral surface. Cauchy problem. Integration of canonical systems and geometric interpretation. Jacobi method.
Examination Format	Essay
Learning and Examination Requirements	Mandatory attendance of online and classroom classes, active participation in discussions of issues, preliminary preparation for lectures and practical classes, high quality and timely completion of SRO assignments, participation in all types of control.

List of literature	1. Arnold V.I. Lectures on Partial Differential Equations. Moscow: MCNMO, 2017. 182 p. 2. Ospanov K.N. Singular Differential Equations. Textbook. – Almaty: Evero Publishing, 2020. – 72 p. Rmeb 3. Omarov T.E. Equations with Partial Derivatives: Textbook / T.E. Omarov, B.K. Shayakhmetova – Almaty: “Evero” Publishing, 2020. – 172 p. Rmeb 4. Omarov T.E., Shayakhmetova B.K. Partial Differential Equations: Textbook / T.E. Omarov, B.K. Shayakhmetova. – Almaty: “Evero” Publishing, 2016. – 188 p. (elib.kz) 5. Nysambayev Zh. Differential Equations. 2016. 6. Imas O.N., Pakhomova E.G., Rozhkova S.V. Lectures on Differential Equations. Publishing House of Tomsk Polytechnic University, 2012. 7. Abdikalikova G.A. Examples and Problems in Differential Equations. Textbook. ISBN 9965-515-24-7, Aktobe, 2000. 79 p. 8. Suleimenov Zh. Course on Differential Equations. 2009. 9. Tikhonov A.N., Vasilieva A.B., Sveshnikov A.G. Differential Equations. Moscow, 1985. 232 p. 10. Filippov A.F. Introduction to the Theory of Differential Equations: Textbook / A.F. Filippov. - 2nd ed., revised. - Moscow: KomKniga, 2007. 11. Filippov A.F. Problem Book on Differential Equations. Izhevsk: Research Center “Regular and Chaotic Dynamics”, 2000. 176 p. 12. Elsgolts L.E. Differential Equations: Textbook / L.E. Elsgolts. - 7th ed. - Moscow: LKI, 2008.

Module 2.2. - Multidimensional analysis and partial differential equations

Module Title	MAMSA 5301- Mathematical analysis on manifolds and stochastic analysis
Semester(s) of Instruction	1
Instructor Responsible	Sartabanov Zh., Professor of the Department of Mathematics
Language of Instruction	Kazakh
Curriculum Association	Profile discipline (PD), university component (UC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Mathematical Analysis, Differential Equations, Differential Geometry, Probability Theory and Mathematical Statistics, Functional Analysis.
Module Objectives / Expected Learning Outcomes	The aim of the course is to significantly expand and deepen the content of such undergraduate courses as mathematical analysis, differential geometry, probability theory and to introduce the most important concepts for modern mathematics and the results of the expanded sections of the above-mentioned disciplines. Learning outcomes. Knowledge and understanding: Demonstrate knowledge and understanding of the modern concept of maps of multidimensional spaces, their differentials, differential forms and operations applied to them, manifolds in Euclidean spaces, the theory of random processes and the theory of stochastic calculus and Martingale theory. Application: Can apply knowledge, understanding and ability to solve problems in natural science, engineering, economics, industrial organization, communication theory, etc. Analysis: Analyze the results, integrate knowledge in solving problems of mathematical analysis on manifolds and stochastic analysis, and give an example of applications. Synthesis: Systematize knowledge in the discipline, develop methods for solving applied problems of mathematical analysis on manifolds and stochastic analysis. Assessment: Give an assessment of the application of the completed material in solving applied problems.
Content	This course examines mathematical analysis on manifolds and will consistently introduce students to modern concepts of maps of multidimensional spaces, their differentials, differential forms and operations used by them, and manifolds in Euclidean spaces. Next, an introduction to the theory of stochastic analysis is considered, it outlines the basic concepts of the theory of random processes and the theory of stochastic calculus, in particular, the theory of the stochastic integral of Ito (according to the Wiener process) and the theory of martingales. The material considered in the course is related to the courses of mathematical analysis, differential geometry, probability theory and mathematical statistics and has a general character and can be applied in the course of their future scientific and practical activities.
Examination Format	Oral
Learning and Examination Requirements	The final assessment takes place in the format of an exam. The exam is conducted in accordance with the university's academic integrity policy and exam rules. If plagiarism or cheating is detected, the exam results are automatically canceled, and the discipline will be re-studied in the summer semester. Form of final control (exam): traditional (exam card-oral, tasks and examples). Exam questions in the discipline – 100. The ticket consists of two questions: the first question corresponds to the theoretical provisions, including the formulation of problems and methods of solution; the second question corresponds to the application (appendix). The results of the exam are entered by the teacher in an electronic form in the "Platonus" system.

List of literature	1. Ignatochkina, L. A. *Analysis on Manifolds*. Moscow: Moscow State Pedagogical University, 2015. 211 pages. https://www.twirpx.com/file/2519855/ 2. Egorov, A. I., Kashargin, P. E. *Differentiable Manifolds and Riemannian Geometry.* Kazan: Kazan State University, 2010. 30 pages. https://www.twirpx.com/file/2052787 3. Zorich, V. A. *Mathematical Analysis.* Part II. Moscow: ICNMO, 2017. 676 pages. http://math.uchicago.edu/~eskin/math203/Analiz%201%20(2012).pdf 4. Zhukovsky, M. E., Rodionov, I. V., Shabanov, D. A. *Fundamentals of the Theory of Random Processes.* Moscow: MIPT, 2016. 121 pages. https://istina.msu.ru/download/43787921/1gH3jj:QEdAixNdehcfTxu0P4EH-7D0Pzc/ 5. Gasnikova, A. V. *Lectures on Random Processes.* Moscow: MIPT, 2019. 254 pages. https://arxiv.org/pdf/1907.01060.pdf 6. Matalytskiy, M. A. *Probability Theory, Mathematical Statistics.* Minsk: Vysshaya Shkola, 2017. 591 pages. https://vshph.com/upload/inf/978-985-06-2855-8.pdf 7. Bekareva, N. D. *Random Processes.* Novosibirsk: NSTU Publishing House, 2016. 127 pages. http://library.kuzstu.ru/meto.php?n=233613.pdf&type=nstu:common 8. Nasyrov, F. S. *Local Times, Symmetric Integrals and Stochastic Analysis.* Moscow: FIZMATLIT, 2011. 212 pages. https://www.twirpx.com/file/2421510 9. Monsik, V. B., Skrynnikov, A. A. *Probability and Statistics.* Ed. Kabakbaev, S. Zh. Almaty: MV-Print, 2012. 425 pages. http://rmebrk.kz 10. Galazhinskaya, O. N., Moiseeva, S. P. *Theory of Random Processes.* Tomsk: Publishing House of Tomsk State University, 2015. Part 1. 128 pages. https://b-ok.asia/book/2910538/9743eb?regionChanged=&redirect=22822140 11. Aukazhiyeva, Zh. M. *Theory of Mathematical Processing of Geodetic Measurements.* Almaty: CyberSmith, 2017. 152 pages.

Module Title	FOPDEA 5206 The first order partial differential equations and its applications (in Russian)
Semester(s) of Instruction	2
Instructor Responsible	Bekbauova A.U., Ph.D., Associate Professor
Language of Instruction	Russian
Curriculum Association	Basic discipline (BD), Elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Mathematical analysis on manifolds and stochastic analysis, differential equations, mathematical physics and numerical methods for their solution.

Module Objectives / Expected Learning Outcomes	Partial differential equations of the first order serve as a model for various physical processes. The purpose of the discipline is to study current problems in the theory of partial differential equations, apply methods of the theory of differential equations to describe the patterns of physical phenomena, acquire skills in independent work with methods of finding solutions, and form a worldview on the role of differential equations in the system of sciences. Learning outcomes: A) Know the basics of the theory of partial differential equations of the first order, methods of solving differential equations; B) Be able to use the basic classical methods of solving problems for differential equations, to teach practical methods of solving problems to describe the patterns of various physical phenomena; C) Develop the skills to work independently with solution-finding methods to problems of differential equations and formulate conclusions describing the patterns of the problems under consideration; D) In the field of communication, be able to build mathematical models of physical processes; E) Be able to work independently with the basic methods of finding solutions to problems.
Content	Formulation of the problem of integrating partial differential equations. A linear partial differential equation of the first order. The solution of the Cauchy problem and its geometric interpretation. The Pfaff equation. Geometric interpretation of integral types and characteristic lines. Definitions of characteristic lines on an integral surface, differential equations of characteristics and their construction. Construction of an integral surface from characteristics. The Cauchy problem. The Cauchy method for n independent variables. Building a solution from the characteristics. The Jacobi method. Geometric theory of partial differential equations of the first order.
Examination Format	Essay
Learning and Examination Requirements	Study of the materials offered on the UNIVER database and timely completion of tasks according to the schedule of assignments for the course and DEADLINES.
List of literature	**Core Reading** 1. Gustavo L.V. *Partial Differential Equations of First Order and Their Applications to Physics* (2nd edition), 2012, World Scientific 2. Hyun-Ku R., Rutherford A., Neal Russell A. *First-Order Partial Differential Equations, Volume 1: Theory and Applications of Single Equations,* 2001, Dover Publications 3. Andrei D. P., Valentin F. Z., Alain M. *Handbook of First-Order Partial Differential Equations,* 2002, CRC Press 4. Arik M. *Generalized Characteristics of First Order PDEs: Applications in Optimal Control and Differential Games,* 1998, Birkhäuser **Supplementary Reading** 5. A. D. R. Choudary, Saima Parveen, Constantin Varsan. Title: *Partial Differential Equations: An Introduction*, 2010, arXiv 6. E. Kamke *Handbook on First-Order Partial Differential Equations*, 1966, Nauka 7. V. F. Zaitsev, A. D. Polyanyin *Handbook on First-Order Partial Differential Equations*, 2003, Fizmatlit

Module 3. - Modern educational technologies

Module Title	TMTMHS 5302 Theory and methods of teaching mathematics in high school (in Kazakh)
Semester(s) of Instruction	2
Instructor Responsible	Kagazbayeva A., Professor
Language of Instruction	Kazakh
Curriculum Association	Profile discipline (PD), university component (UC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Didactics of higher education, fundamental issues of algebra, geometry, analysis.
Module Objectives / Expected Learning Outcomes	Objective: to train professional mathematicians with modern knowledge, methods and technologies for scientific research and pedagogical activity in the system of higher professional education. A. Knowledge and understanding of the didactic foundations of teaching mathematics in higher education, the features of mathematics as a scientific and academic subject, the main didactic principles of teaching mathematics, the main components of the content of mathematical knowledge and the features of its presentation in mathematics courses, the integrated organization of training and methods of testing students' knowledge. B. Ability to apply knowledge of higher education didactics in their pedagogical activity; knowledge of the theory and methods of teaching mathematics, modern information technologies, interactive learning methods in designing mathematical lessons in the educational process. C. Ability to analyze the components of the subject "Theory and Methods of Teaching Mathematics in Higher School (TiMOMvVSh)" as a pedagogical system; classify the forms, types of lessons, methods and techniques of teaching mathematics in higher educational institutions; distinguish the features of the application of interactive methods and techniques of teaching in higher education. D. Ability to comprehensively use the acquired competencies in the subject in designing a lesson in mathematics; integrate interactive methods and techniques for designing lessons in mathematics, write an essay, substantive texts on issues of the theory and methodology of teaching mathematics in higher education. E. Ability to evaluate the subject of TiMOMVSh as a pedagogical system; the importance of using interactive methods in designing mathematics lessons of various forms, create a reflective attitude to one's activities in the process of studying the subject.

Content	Didactic foundations of teaching mathematics in higher education: features of the educational program for this subject; requirements for the continuous education system in the Republic of Kazakhstan. Mathematics as a science and as an academic subject: features of mathematics as a science and an academic subject, theory and methods of teaching mathematics as a pedagogical system; continuity of school and higher mathematics. New technologies for teaching mathematics in higher education: classification of modern technologies in teaching in higher education; features of credit technology for teaching mathematics, critical thinking technology; Bloom's technology as a technology for complete acquisition of competence in higher education mathematics and assessment of the quality of acquisition of knowledge, skills, and abilities; ICT technologies, their application in practical teaching of mathematics to students by forms of teaching (lecture, practical/seminar classes). Interactive methods and techniques in teaching mathematics: classification and features of interactive methods and techniques of teaching in higher education; selection of methods and techniques in accordance with the purpose of teaching a specific topic from a mathematical field in a specific specialty and the features of its mathematical content. Interactive forms and foundations for assessing knowledge, skills, and abilities in mathematics in higher schools: methods for developing skills and abilities in the process of teaching mathematics; monitoring the quality of mathematical education in higher education.
Examination Format	Written work - essay
Learning and Examination Requirements	Each module of the subject requires active participation of postgraduate students in lectures and practical classes. Participation in all types of classes requires preliminary preparation and activity. Assignments for all types of classes are completed weekly within the modules and are assessed at a certain share of the established points according to pre-set criteria. The organization and conduct of the final assessment (exam) is carried out in accordance with the regulations on the midterm assessment (examination session) of students approved by the Chairman of the Board of the ARU named after K. Zhubanov: P.12. Organization of the written exam. P12.3 Assessment criterion 12.3.1 Written work is assessed according to 5 different criteria (each section is assigned 20 points): 1) Knowledge and understanding of the topic (ability to open a topic); 2) Level of research and analysis, conclusion; 3) Structure and sequence of the project; 4) Level of use of scientific sources; 5) Style of written work (grammar) and brevity of presentation.

List of literature	**Core Reading:** 1. The Law of the Republic of Kazakhstan on Education, Law No. 319, July 27, 2007 // Internet source: http://kazbilim.kz. 2. State Program for the Development of Education and Science of the Republic of Kazakhstan for 2020–2025: Project. – December 2019. 3. The "Pedagogical Status" Law of the Republic of Kazakhstan. – Nur-Sultan, Akorda, December 27, 2019, No. 293 -VI of the Republic of Kazakhstan. 4. Law of the Republic of Kazakhstan: Amendments and additions to certain legislative acts of the Republic of Kazakhstan on the pedagogical status and reducing the workload of students and teachers. – Nur-Sultan, Akorda, December 27, 2019, No. 294 -VI of the Republic of Kazakhstan. 5. Abilqasimova A.E., Kossanov M.B. The formation and development of teaching methodology of mathematics in Kazakhstan: Textbook. – Almaty: Mektep, 2018. – 264 pages. 6. Adilbekova E.T., Baymisheva A.Z. Information and communication technologies in education: Textbook, 2014 (RMEB). 7. Janaberdieva S.A., Kagazbaeva A.K., et al. Scientific-methodical foundations for improving the mathematical training of students and postgraduates in pedagogical universities: Monograph – Almaty: Abai KazNPU, 2013. – 398 pages. 8. Baisheva K.S. Elementary mathematics for 5B010900-Mathematics specialty: Teaching-methodical complex / K.S. Baisheva, L.S. Sultanalieva. – Electronic text data. – Aktobe: AktMPI, 2012. (Code 22.10/ B 12–712499). 9. Bazarbaeva G.S., Baymadiyeva G.A., Raihan M. Higher mathematics: Textbook / G.S. Bazarbaeva, G.A. Baymadiyeva, M. Raihan. – Almaty: Evero, 2014. – 201 pages. (Code 22.1ya73/B16-397873). 10. Bazarbaeva G.S. Higher mathematics. [Text]: A brief course. Textbook / G.S. Bazarbaeva. – Almaty: Evero, 2014. – 201 pages. (Code 22.1ya73/B16-848852). 11. Beisebay P.B. Higher mathematics [Text]: Methodical instructions / P.B. Beisebay. – Ust-Kamenogorsk: ShKMTU, 2012. – 96 pages. (Code 22.1/B38-123730). 12. Higher mathematics in exercises and problems [Text]: Textbook. In 2 parts. Part 1 / P.E. Danko, A.G. Popov, T.Ya. Kozhevnikova et al. – 7th ed., revised. – Moscow: ONIKS, 2008. – 368 pages: ill. (Code 22.11ya73/V937-590610). 13. Higher mathematics in exercises and problems [Text]: Textbook. In 2 parts. Part 2 / P.E. Danko, A.G. Popov, T.Ya. Kozhevnikova et al. – Moscow: ONIKS, 2008. – 448 pages: ill. (Code 22.11ya73/V937-319213). 14. Duisegalieva A.D. Internet technologies in the learning process: To the study of the discipline. – 2010. 15. Zavalco N.A. Modern pedagogical technologies: Textbook, 2016. 16. Kuzhukeiev Zh.M. Algebra and Geometry: Textbook / Zh.M. Kuzhukeiev. – Almaty: Otan, 2015. – 124 pages. (Code 22.14ya73/K81-923574). 17. Kusaev G.M., Kagazbaeva A.K., Saginov K.M., Abykanova B.T., Konurova Z.K., Nugumanova S.B. Fundamentals of Didactics: Textbook. – Nur-Sultan: DBB "Nazarbayev Intellectual School" Pedagogical Mastery Center, 2019. – 422 pages. 18. Kusaev G.M., Kagazbaeva A.K., Abykanova B.T., Aitbaeva D.B., Maldybaeva L.R., Nugumanova S.B. Science of teaching and new educational practices: Teaching-methodical tool: Volume 1. – Nur-Sultan, Almaty: "TechSmith Publishing", 2019. – 258 pages. 19. Kusaev G.M., Kagazbaeva A.K., Abykanova B.T., Aitbaeva D.B., Maldybaeva L.R., Nugumanova S.B. Science of teaching and new educational practices: Teaching-methodical tool: Volume 2. – Nur-Sultan, Almaty: "TechSmith Publishing", 2019. – 268 pages. 20. Department of Mathematics: Teaching-methodical complexes and syllabuses. – Electronic text data. – Aktobe: AktMPI, 2012. (Code 22.1/M 34–787769).

	21. Musin A.T. Mathematics 1. (Lectures. Test collection) [Text]: Textbook / A.T. Musin. – Almaty: Dauir, 2012. – 312 pages. (Code 22.1(5Kaz)ya73/M79-442265). 22. Musin A.T. Mathematics 2. (Lectures. Test collection) [Text]: Textbook / A.T. Musin. – Almaty: Dauir, 2012. – 392 pages. (Code 22.1(Kaz)ya73/M79-740283). 23. Musin A.T. Mathematics Vol. I. (Lectures. Problem collection): Textbook / A.T. Musin. – Almaty: Dauir, 2012. – 312 pages. (Code 22.1(5Kaz)ya73/M79-918786). 24. Musin A.T. Mathematics Vol. II. (Lectures. Test collection): Textbook / A.T. Musin. – Almaty: Dauir, 2012. – 392 pages. (Code 22.1(5Kaz)ya73/M79-842756). 25. Nugusova A. Didactic foundations of teaching mathematical analysis in higher education institutions, 2016. 26. Ospanov T. Theoretical foundations of mathematics [Text]: Textbook / T. Ospanov, Sh. Kurmanalina, S. Kurmanalina. – 2nd ed. – Astana: Foliant, 2012. – 352 pages. (Code 22.1ya722/O-78–425798). 27. Otarov Kh.T. Mathematical analysis [Text]: Textbook / Kh.T. Otarov. – Almaty: Ekonomika, 2012. – 536 pages. (Code 22.16ya73/O-81–324494). 28. Otarov Kh.T. Mathematical analysis [Text]: Textbook / Kh.T. Otarov. – Almaty: "Ekonomika" Publishing House, 2012. – 536 pages. (Code 22.16ya73/O81-582375). 29. Shevchuk V.E. Practicum on the use of interactive technologies in the educational process: Textbook. – 2015. 30. Tleubergenova M.A. Elements of linear algebra for specialty 5B010900-"Mathematics": Methodological instructions and individual assignments / M.A. Tleubergenova, G.S. Tamova. – Electronic text data. – Aktobe: AGPI, 2012. (Code 22.143/T 49–455442). **Supplementary Reading:** 1. Abylkassymova A.E. Questions of theory and methodology of teaching in higher education. – Almaty: Вілім, 1998. – 176 p. 2. Abylkassymova A.E. The state, problems, and main directions of development of the education system in the Republic of Kazakhstan // Collective monograph "Higher Education in Russia and Abroad: Problems and Their Solutions (Chapter 2, §2.5)". – Ulyanovsk: Zebra, 2017. – pp. 157-170. 3. Abylkassymova A.E., Asanaliev M.K. Pedagogical technologies for organizing independent work of students. – Bishkek: Pedagogika, 2002. – 144 p. 4. Abylkassymova A.E., Akhmetov A.K., Basharov R.B., et al. Concept of the state standard of higher education in the Republic of Kazakhstan. – Almaty: RIK, 1998. – 96 p. 5. Abylkassymova A.E., Vinnitskaya M.A., et al. Improving the structure and content of higher education in the Republic of Kazakhstan. – Almaty: RIK, 1999. – 152 p. 6. Abylkassymova A.E., Tynybekova S.D. Issues of professional and pedagogical orientation of teaching in universities. – Almaty: Komplex, 1999. – 130 p. 7. Abylkassymova A.E., Ushurov E.A., Omarova R.S. 12-year education. Development of the system of general secondary education in the modern world: Monograph. – Almaty: Ғылым, 2003. – 106 p. 8. Abylkassymova A.E., Ryzhkov M.V., Shishov S.E. Modern trends in the development of continuous pedagogical education. – Almaty: Atammura, 2017. – 272 p. 9. Arkhangelsky S.I. The educational process in higher education, its regular foundations and methods. – Moscow: Vysshaya Shkola, 1980. – 368 p. 10. Al-Farabi. Logical treatises / Academy of Sciences of the Kaz. SSR. Institute of Philosophy and Law; editorial board: A.M. Kunaev, Zh.M. Abdildin, A.V. Sagadaev. – Alma-Ata, 1975. – 556 p.

11. Arkhangelsky S.I. Lectures on the theory of teaching in higher education. – Moscow: Vysshaya Shkola, 1974. – 384 p.
12. Äbılqasımova A.E. The development process of higher education in the Republic of Kazakhstan. – Almaty: Bіlім, 1999. – 249 p.
13. Äbılqasımova A.E. Forming cognitive curiosity in students. – Almaty: Bіlім, 1994. – 192 p.
14. Äbılqasımova A.E., Omarova R.S. Fundamentals of forming cognitive curiosity in teachers. – Almaty: Ғылым, 2003. – 144 p.
15. Älimov A. The use of interactive methods in higher education institutions: Educational tool / A. Älimov. – 2009. – RMEB
16. Djanaberdieva S.A. Modern mathematics (6N0109 – Mathematics specialties) // Typical program for higher professional education / Ministry of Education and Science of the Republic of Kazakhstan. – Almaty, 2007. – pp. 34–44.
17. Zhautykov O.A. History of the development of mathematics. – Almaty, Mektep, 1967.
18. Kagazbayeva A.K. Theoretical and technological foundations of the methodological preparation of future mathematics teachers in universities. – Almaty: RIK, 1998. – 299 p.
19. Kösherbaev K.E., Äbılqasımova A.E. and others. Strategy for the development of higher education in the Republic of Kazakhstan. – Almaty: Bіlім, 1998. – 232 p.
20. Qağazbaeva Ä.K., Qaidasov Zh. Practicum on the theory and methodology of teaching mathematics. – Almaty: Ғылым, 2003. – 100 p.
21. Lyashchenko E.I., Zobkova K.V. et al. Laboratory and practical work on the methodology of teaching mathematics. – Moscow: Prosveshchenie, 1988.
22. Mathematics in concepts, definitions, and terms: Part 1. A handbook for teachers / edited by L.B. Sabinina. – Moscow: Prosveshchenie, 1978. – 320 p.
23. Ospanov T. Theoretical foundations of mathematics [Text]: Textbook / T. Ospanov, Sh. Kurmanalina, S. Kurmanalina. – 2nd ed. – Astana: Foliant, 2012. – 352 p. (Code 22.1я722/O-78–425798).
24. Methodology and technology of teaching mathematics. Course of lectures: a manual for universities / scientific editors N.L. Stefanova, N.S. Podkhodova. – Moscow: Drofa, 2005. – 416 p.
25. Sabalakov A. History of mathematics. – Almaty: Mektep, 1966.
26. Sadykov T.S., Äbılqasımova A.E. Didactic foundations of education in higher education. – Almaty: Ғылым, 2003. – 168 p.
27. Sadykov T.S., Äbılqasımova A.E. Methodology of 12-year education. – Almaty: Ғылым, 2003. – 164 p.
28. Sadykov T.S., Abylkassymova A.E. Didactics of higher education. – Almaty: RIK, 2000. – 208 p.
29. Stolyar A.A. Pedagogy of mathematics. – Minsk: Vysshaya Shkola, 1986.

Online resources:

1. Kozhukova V.I., Zolina O.F. The Pedagogue of Higher Education as a Teacher and Researcher // http://evansys.com/articles/innovatsionnye-vnedreniya-v-oblasti-pedagogiki-i-psikhologii-sbornik-nauchnykh-trudov-po-itogam-mezh/sektsiya-7-pedagogika-vysshey-professionalnoy-shkoly/pedagog-vysshey-shkoly-kak-prepodavatel-i-issledovatel/
2. Mathematical Analysis – 2 / Textbooks – [Electronic resource, 2011] – Access mode: Mathematical Analysis – 2 – [Electronic resource, 2011] – Access mode: http://kvm.gubkin.ru/index.html.
3. Mathematics – 2 / Textbooks – [Electronic resource, 2011] – Access mode: http://MFH.gorodok.net/.
4. Mathematics – 2 / Lectures – [Electronic resource, 2011] – Access mode: www.google.ru
5. Mathematics – 2 / Textbooks – [Electronic resource, 2011] – Access mode: www.google.kz
6. Mathematics – 2 / OAC – [Electronic resource, 2011] – Access mode: www.kaznpu.kz

	7. Omarova Ä.T., Chinasilova A.M., Amitov S.A. Teachers of Higher Education Institutions as the Main Subject of Higher Education // https://articlekz.com/kk/article/17497http://ru.wikipedia.org/wiki/Преподаватель.

Module 4.1. - Modern problems of differential equations

Module Title	DEMPhNMTS 5207 Differential equations, mathematical physics and numerical methods of their solution (in English)
Semester(s) of Instruction	1
Instructor Responsible	Abdikalikova G.A., Professor of the Department of Mathematics
Language of Instruction	Russian
Curriculum Association	Basic discipline (BD), elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	To master this module, you need knowledge, skills and abilities acquired while studying the following courses: Differential Equations, Equations of Mathematical Physics, Mathematical Analysis, Algebra, Function theory, Functional Analysis and the theory of Integral Equations.
Module Objectives / Expected Learning Outcomes	The aim of the training is to deepen the knowledge and familiarize the master's students with current problems of differential equations and mathematical physics, to develop principles for constructing numerical algorithms, on the basis of which the most rational strategy for numerical solution of problems is implemented, to demonstrate the ability to find effective algorithms for solving problems of computational mathematics. A. Demonstrate knowledge and understanding of current issues in the general theory of differential equations, equations of mathematical physics and numerical methods in conducting scientific research. B. To generate knowledge, understanding and ability to creatively apply research methods in constructing mathematical models of physical processes and finding solutions to corresponding problems of differential equations and equations of mathematical physics. C. Integrate knowledge, formulate current problems of differential equations and equations of mathematical physics, develop principles for constructing numerical algorithms, on the basis of which the most rational strategy for numerically solving problems is implemented. D. Communicate your knowledge, conclusions and ideas to the scientific community, justify the implementation and forecasting of research results in practice. E. Continue independent training in priority areas of natural sciences in the context of the growth of information and communication technologies.

Content	The general problem of Cauchy and unrequited boundary value problem for linear differential equations. Green function. Presentation of the solution of boundary value problems for the second order linear differential equations. The general theory Elliptic and Parabolic and Hyperbolic equation. Equations of mixed and mixed-composite type. Methods for solving initial and boundary value problems for mixed type equations. Methods for solving initial and boundary value problems for equations of composite type. Nonlocal initial and boundary value problems for partial differential equations. Loaded integral and differential equations and methods for their solution. Approximate and numerical methods for solving linear problems of mathematical physics. Iterative and variation solution methods nonlinear problems. Numerical methods for solving hydrodynamic problems. Variation-difference methods. Finite element method.
Examination Format	Essay
Learning and Examination Requirements	Mandatory attendance of online and classroom classes, active participation in discussions of issues, preliminary preparation for lectures and practical classes, high quality and timely completion of SRO assignments, participation in all types of control.

List of literature	1. Wevers J.C.A. Mathematics Formulary. January 6, 2002 – 66 p. 2. Petrovsky I.G. Lectures on the Theory of Ordinary Differential Equations. M., 1984. 3. Rush N., Abets, Lalua M. Lyapunov's Direct Method in Stability Theory. M., 1980. 4. Malkin I.G. The Theory of Stability of Motion. M-L., 1952. 5. Moiseev N.N. Mathematical Problems of System Analysis. M., 1981. 6. V.I. Arnold. Ordinary Differential Equations / V.I. Arnold. – Moscow: MTsNMO, 2012. – 344 p. (in Russian) 7. V.V. Amelkin. Differential Equations in Applications / V.V. Amelkin. – Moscow: KD Librokom, 2012. – 208 p. (in Russian) 8. J. Suleimenov. A Course of Differential Equations. – Almaty: Rauan, 1991. – 360 p. (in Kazakh) 9. J. Suleimenov. Differential Equations 2. – Almaty: Education, 1996. – 256 p. (in Kazakh) 10. L.E. Elsgolts. Differential Equations: Textbook / L.E. Elsgoltz. – Moscow: LKI, 2014. – 312 p. (in Russian) 11. A.F. Filippov. Collection of Problems on Differential Equations. / A.F. Filippov. – Izhevsk: Research Center "Regular and Chaotic Dynamics", 2000. – 176 p. (in Russian) 12. O.A. Oleinik. Lectures on Partial Differential Equations. – Moscow: Binom. Knowledge Laboratory, 2012. – 260 p. (in Russian) 13. I.G. Petrovsky. Lectures on Partial Differential Equations. – Moscow: FIZMATLIT, 2009. (in Russian) 14. V.A. Trenogin, I.S. Nedosekina. Partial Differential Equations. – Moscow: FIZMATLIT, 2013. – 228 p. (in Russian) 15. D.U. Umbetzhanov. Almost Periodic Solutions of Evolutionary Equations. – Alma-Ata: Nauka, 1990. – 184 p. (in Russian) 16. Apolonsky S.M. Differential Equations of Mathematical Physics in Electronics. / S.M. Apolonsky. – St. Petersburg: Piter, 2012. – 352 p. 17. Vladimirov V.S. Equations of Mathematical Physics. M.: Nauka, 1988. – 512 p. 18. Mikhlin S.G. A Course in Mathematical Physics. M.: Nauka, 1968. – 575 p. 19. Ladyzhenskaya O.A., Uraltseva N.N. Linear and Quasilinear Elliptic Equations. M., 1964. – 538 p. 20. Budak B.M., Samarsky A.A., Tikhonov A.N. A Collection of Problems in Mathematical Physics. M.: Nauka, 1988. – 512 p. 21. Mikhailov V.P. Differential Equations in Partial Derivatives. M., 1983. – 424 p. 22. Tokybetov Zh.A., Khayrullin E.M. Mathematical Physics Equations. Almaty, 1995. – 297 p. 23. Bitsadze A.V. Equations of Mathematical Physics. M.: Nauka, 1976. 24. Vladimirov V.S., Zharinov V.V. Equations of Mathematical Physics: Textbook. M.: Fiz.-matem. lit., 2000. 25. Ptashnik B.I. Incorrect Boundary Problems for Differential Equations with Partial Derivatives. Kiev, 1984. – 264 p. 26. Sobolev S.L. Equations of Mathematical Physics. M.: Nauka, 1967. – 444 p. 27. Oleinik O.A. Lectures on Equations with Partial Derivatives. M.: BINOM, 2012. – 260 p. 28. Abdikalikova G.A. Examples and Problems on Differential Equations. Textbook. ISBN 9965-515-24-7, Aktobe, 2000. – 79 p. 29. Abdikalikova G.A., Berzhanov A.B. Problems on Equations of Mathematical Physics: Textbook. ISBN 9965-02-133-3, Aktobe: Litera-A, 2007. – 143 p. 30. Abdikalikova G.A. Methodological Guidelines: Glossary on the Course "Equations of Mathematical Physics". Aktobe: RIO AGU named after K. Zhubanova, 2010. 31. Kalitkin N.N. Numerical Methods. M.: Nauka, 1978. 32. Demidovich B.P., Maron I.A., Shuvalova E.E. Numerical Methods in Analysis. M.: Nauka, 1967. 33. Bakhvalov N.S. Numerical Methods. Vol. 1. 2nd edition, M.: 1975. 34. Sobol I.M. Numerical Methods of Monte Carlo. M.: Nauka, 1973.

	35. Samarsky A.A. Theory of Difference Schemes. M.: Nauka, 1977. 36. Marchuk G.I. Methods of Computational Mathematics. M.: Nauka, 1989. 37. Babenko K.I. Fundamentals of Numerical Analysis. M.: Nauka, 1986. 38. Samarsky A.A., Gulin A.V. Numerical Methods. M.: Nauka, 1989. **Online resources** www.math-atlas.org www.awl-elt.com www.penguinenenglish.com www.cambridge.org www.oxford.org

Module Title	NEMPhTA 5208 Non-classical equations of mathematical physics and their applications (in Kazakh)
Semester(s) of Instruction	2
Instructor Responsible	Abdikalikova G.A., Professor of the Department of Mathematics
Language of Instruction	Russian
Curriculum Association	Basic discipline (BD), elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	To master this module, you need knowledge, skills and abilities acquired while studying the following courses: Mathematical analysis on manifolds and Stochastic analysis; Differential equations, Mathematical physics and Numerical methods for their solution.
Module Objectives / Expected Learning Outcomes	The aim of the training is to deepen the knowledge and familiarize the graduate students with current problems of non-classical equations of mathematical physics, teach the graduate students methods of research and solving boundary value problems, develop the ability to find effective algorithms for solving problems, form a scientific worldview and foster a mathematical culture. A. Demonstrate knowledge and understanding of current problems of non-classical equations of mathematical physics when conducting scientific research; B. Generate knowledge and new ideas in the context of scientific research on problems of non-classical equations of mathematical physics and artificial intelligence, understanding and ability to creatively apply research methods in constructing mathematical models of physical processes and finding solutions to non-local boundary value problems; C. Integrate knowledge, formulate current problems of boundary value problems of non-classical equations of mathematical physics, develop principles and approaches to studying boundary value problems with non-local conditions; D. Communicate your knowledge, conclusions and ideas to the scientific community, justify the implementation and forecasting of the results of studying non-classical equations of mathematical physics; E. Continue independent training in priority areas of natural sciences in the context of the growth of information and communication technologies. In the field of training - the ability to analyze problems of problems of non-classical equations of mathematical physics.

Content	Differential equations and boundary value problems. Problems reduced to partial differential equations. Systems of equations according to Friedrichs and Courant. Solvability of a nonlocal boundary value problem. Necessary and sufficient coefficient conditions for the existence and uniqueness of a solution to a nonlocal boundary value problem. Statement of boundary value problems for a non-classical equation of mathematical physics of the second order. Iterative methods for constructing solutions. Correct and unique solvability. Algorithm for finding a solution. Statement and generalized solution of a boundary value problem with a non-local condition for a non-classical equation in partial derivatives of the second order. Nonlocal boundary value problem for a mixed-composite type equation.
Examination Format	Essay
Learning and Examination Requirements	Mandatory attendance of online and classroom classes, active participation in discussions of issues, preliminary preparation for lectures and practical classes, high quality and timely completion of SRO assignments, participation in all types of control.
List of literature	1. Arnold, V.I. Lectures on Partial Differential Equations. Moscow: MCCME, 2017. 182 p. 2. Sobolev, S.L. Equations of Mathematical Physics. Moscow: Nauka, 1966. 444 p. 3. Vragov, V.N. Boundary Value Problems for Nonclassical Equations of Mathematical Physics. Novosibirsk State University, 1983. 84 p. 4. Bitsadze, A.V. Some Classes of Partial Differential Equations. Moscow: Nauka, 1981. 5. Vladimirov, V.S. Equations of Mathematical Physics. Moscow: Nauka, 1981. 512 p. 6. Courant, R. Partial Differential Equations. Moscow: Mir, 1964. 830 p. 7. Oleinik, O.A. Lectures on Partial Differential Equations. Moscow: BINOM, 2012. 260 p. 8. Schwartz, L. Mathematical Methods for the Physical Sciences. Moscow: Mir, 1965. 9. Nakhushev, A.M. Shift Problems for Partial Differential Equations. Moscow, 2006. 287 p. 10. Tokybetov, Zh.Ä., Khairullin, E. Equations of Mathematical Physics, 2010. 11. Ramazanov, M.I., Mukhtarov, M., Ädilbek, N. Fundamental Equations of Mathematical Physics. Karaganda, 2014. 324 p. 12. Orynbasarov, M.O., Sakhaev, Sh. Problems in Mathematical Physics Equations, 2009. RMEB. 13. Pikulin, V.P., Pokhozhaev, S.I. A Practical Course on Equations of Mathematical Physics. MCCME, 2004. 208 p. 14. Apollonsky, S.M. Differential Equations of Mathematical Physics in Electronics. St. Petersburg: Piter, 2012. 352 p. 15. Umbetzhanov, D.U. Almost Periodic Solutions of Evolution Equations. Almaty, 1988. 240 p. 16. Problem Book on Equations of Mathematical Physics / V.S. Vladimirov, A.A. Vasharin, Kh.Kh. Karimov et al.; Ed. by V.S. Vladimirov. 3rd ed. Moscow: Fizmatlit, 2001. 17. Abdikalikova, G.A., Berzhanov, A.B. Problems on Equations of Mathematical Physics: A Study Guide. ISBN 9965-02-133-3, Aktobe: Litera-A, 2007. 143 p.

Module Title	IDE 5303 Impulsive differential equations (in English)
Semester(s) of Instruction	2
Instructor Responsible	Akhmet M. F.- Doctor of Physico-Mathematical Sciences, Professor, Nugaeva Z.T., PhD, Associate Professor
Language of Instruction	English
Curriculum Association	Profile discipline (PD), elective component (EC)
Modes of Instruction	Lectures, practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work

Workload (Including Contact Hours and Independent Study)	Total hours: 120 h. Contact hours: 40 h. (20 h. of lectures, 20 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 20 h. of MSIWT, 60 h. of MSIW
ECTS	4
Prerequisites (Mandatory and Recommended)	Prerequisites: mathematical analysis, algebra, geometry, differential equations
Module Objectives / Expected Learning Outcomes	The purpose of the training: to teach the course of differential equations with a pulsed effect in English, to develop a mathematical culture and to get used to working with textbooks. Training results: 1.knowledge and understanding of mathematical terms, methods of teaching mathematically literate Geru and English in the course of differential equations with a pulsed effect. 2.be able to use the studied mathematical methods; understand mathematical methods in the specialty and apply them in practice; be able to solve mathematical problems. 3.independent understanding of the mathematical apparatus in the literature, depending on the specialty of the Student; selection and application of the necessary calculation methods, tools. 4.ability to independently prepare a message, report in English on the concepts of the course differential equations with a pulsed effect. 5.be able to evaluate the significance of the material on the course, the adequacy of the conclusions; be able to interpret the results.
Content	The discipline "Impulsive differential equations" plays an important role in the generalization of the knowledge gained in the course of ordinary differential equations, the presence and sole of the solution of differential equations and their systems in the presence of moments of interruption, that is, impulses, the study of the integral transfer, stability and periodicity of the solution in English; the formation of the skills of effective use of theoretical knowledge in solving mathematical problems and the development of logical thinking of students, as well as their creative competencies. The course is aimed at the formation of knowledge, skills, skills of undergraduates and their constant testing, mastering the terms of the course of Pulse differential equations in English.
Examination Format	Essay
Learning and Examination Requirements	It is well versed in the definition of continuous and partial continuous functions, pulse differential equations and their systems, and the concept of solution of Pulse differential equation, solution of Pulse differential equations in which moments of interruption are constant and variable, solution of homogeneous and inhomogeneous linear pulse equations and their systems, definition of fundamental solution systems. Correctly performs calculations related to these topics. There is a mathematical word stock in English on the above topics, but some term does not know the translation of words. Can explain ways to solve problems in English, but has difficulty answering additional questions. In the process of solving problems, he will be able to speak the game in English.

List of literature	**Core Reading** 1. Akhmet, M. *Principles of Discontinuous Dynamical Systems*. – New York: Springer, 2010. – 189 p. 2. Samoylenko, A.M., Perestyuk, N.A. *Differential Equations with Impulsive Effects*. – Kyiv: Vyshcha Shkola, 1987. – 287 p. 3. Aruğaslan Çinçin, D. *Introduction to Impulsive Differential Equations*. – Turkey: Palme Publishing, 2015. – 112 p. **Supplementary Reading** 1. Tleubergenova, M.A. *Asymptotic Properties of Systems of Differential Equations*. – Aktobe, 2020. – 114 p. 2. Lakshmikantham, V., Bainov, D.D., Simeonov, P.S. *Theory of Impulsive Differential Equations*. – Singapore: World Scientific, 1989. – 288 p. 3. Stamov, G.T. *Almost Periodic Solutions of Impulsive Differential Equations*. – Berlin–Heidelberg: Springer-Verlag, 2012. – 235 p. 4. Adkins, W.A., Davidson, M.G. *Ordinary Differential Equations*. – New York: Springer, 2012. – 815 p.

Module 4.2. - Probability theory, mathematical statistics and Stochastic processes

Module Title	AChPT 5207 Additional chapters of probability theory (in English)
Semester(s) of Instruction	1
Instructor Responsible	Tleubergenova M. A., Ph. D., Associate Professor
Language of Instruction	Ehglish
Curriculum Association	Basic discipline (BD), Elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Probability Theory and Mathematical Statistics
Module Objectives / Expected Learning Outcomes	The main purpose of studying the course "Additional chapters of probability theory" - study of the following sections: probability density functions of random variables, distribution of functions of one and two random arguments, system of two random variables, modeling of random variables by the Monte Carlo method. Learning outcomes: A) Know the basic concepts of the formula of such sections of probability theory as the probability distribution density functions of random variables, the distribution of the function of one and two random arguments, the system of two random variables and the Monte Carlo simulation of random variables. B) Be able to apply formulas in solving typical problems, conduct research using the Monte Carlo method. Be able to interpret the results obtained using the Monte Carlo method. C) Ability to formulate conclusions in the field of professional activity. Be able to set a goal and choose ways to achieve it. Be able to draw conclusions and report on the work done. Have the ability to express your thoughts logically correctly and clearly. D) Conduct reasoned conversations, express their opinion on the issues discussed. Ability to communicate effectively with others, including working in joint projects and events, working with others; positively accept innovations and changes; use scientific approaches to modern information. Ability to communicate with experts from other fields. E) The ability to master sections of fundamental sciences independently. The ability to find, analyze and specifically process information, including those related to new areas of knowledge that are not directly related to the field of professional activity.
Content	Functions of the probability distribution density function of random variables, distribution of functions of one and two random arguments, system of two random variables, modeling (playing out) of random variables by the Monte Carlo method. Because of its efficiency and convenience, this method is used in all exact sciences, including economics (mathematical analysis on manifolds and stochastic analysis).
Examination Format	Essay
Learning and Examination Requirements	Study of the materials offered on the UNIVER database and timely completion of tasks according to the schedule of assignments for the course and DEADLINES.

List of literature	**Core Reading** 1. Frolov A.N. Infinitely Divisible Distributions and Sums of Independent Random Variables, 2023, Lan Publishing. 2. Borodich S.M., Kavitova T.V. Additional Chapters of Probability Theory and Mathematical Statistics, 2018, P.M. Masherov Vitebsk State University. 3. Derr V.Ya. Probability Theory and Mathematical Statistics: A Textbook, 2021, Lan Publishing. 4. Zakrevskaya N.S., Kovalevsky A.P. Special Chapters of Mathematical Analysis: Probability Theory, 2022, Novosibirsk State Technical University. 5. Antonov A.Yu., Varayun M.I. Modeling of Random Variables with a Given Distribution Law: Theorems and Algorithms, 2023, GlobalF5. 6. Benedict G. Joe H., Emily Riehl. Fat Chance: Probability from 0 to 1, 2019, Cambridge University Press. 7. Giacomo B. Game Theory, 2015, Open Access (arXiv). **Supplementary Reading** 8. Kolmogorov A.N. *Foundations of the Theory of Probability*, 1974, Nauka. 9. Gnedenko B.V. *A Course in Probability Theory*, 1969 (many reprints), Nauka. 10. Melekhin V.S. *Probability Theory and Mathematical Statistics*, 2007, Yurayt. 11. Chung K.L. *A Course in Probability Theory*, 2001 (3rd edition), Academic Press. 12. Jacod J., Protter P. *Probability Essentials*, 2004, Springer.

Module Title	SQMS 5208 Selected questions of mathematical statistics (in Kazakh)
Semester(s) of Instruction	2
Instructor Responsible	Akhmetova A. U., Candidate of Physical and Mathematical Sciences, Associate Professor
Language of Instruction	Kazakh
Curriculum Association	Basic discipline (BD), elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Additional Chapters of Probability Theory (in English)
Module Objectives / Expected Learning Outcomes	The main goal of the course is to learn basic graphical representation methods, experimental data processing methods, and classical linear regression analysis. Learning outcomes: A) know the basic concepts of mathematical and applied statistics, basic distributions of random variables; methods for constructing point and interval estimates of the distribution parameters of the general population; B) be able to build histograms of frequencies, relative frequencies and statistical distributions, select approximating functions, use statistical criteria; use basic techniques for processing experimental data; create models of the simplest systems and processes in natural science and engineering; C) master the methods of classical regression analysis and recovery of dependencies based on experimental data, time series analysis, and apply modern mathematical application software packages for processing experimental data; D) be able to logically correctly, argumentatively and clearly construct oral and written speech; E) be able to use the following methods: solutions to communication problems modern technical means and information technologies.

Content	Subject, method, and tasks of statistics. Statistical summary and grouping. Graphical representation of statistical data. Point estimates of numerical characteristics of the distribution. Interval estimates of parameters. Confidence intervals. Testing statistical hypotheses. Testing statistical hypotheses. Consent criteria. Checking the uniformity of samples. Elements of correlation analysis. Sample correlation coefficient. Elements of regression analysis. Multidimensional statistical methods. Elements of cluster analysis. Discriminant analysis.
Examination Format	Essay
Learning and Examination Requirements	Studying the materials offered on the basis of UNIVER and timely completion of tasks according to the schedule of assignments according to the course and SRO.
List of literature	1. Gmurman V.E. Probability Theory and Mathematical Statistics: Textbook for Secondary Vocational Education / V.E. Gmurman. – Lyubertsy: Yurayt, 2016. – 479 p. 2. Bavrin I.I. Probability Theory and Mathematical Statistics / I.I. Bavrin. – Moscow: Vysshaya Shkola, 2005. – 160 p. 3. Borzykh D.A. Probability Theory and Mathematical Statistics in Problems: More Than 360 Problems and Exercises / D.A. Borzykh. – Moscow: LENAND, 2018. – 240 p. 4. Lagutin M.B. Visual Mathematical Statistics / M.B. Lagutin. – Moscow: Binom. Knowledge Laboratory, 2013. – 472 p. 5. Chashkin Yu.R. Mathematical Statistics. Data Analysis and Processing: Textbook / Yu.R. Chashkin; Edited by S.N. Smolensky. – Rostov-on-Don: Phoenix, 2010. – 236 p. 6. Ivanov B.N. Probability Theory and Mathematical Statistics, 2024, Lan′. 7. Larry W. All of Statistics: A Concise Course in Statistical Inference, Springer, 2010 (13th printing). 8. Trevor H., Robert T., Jerome F. The Elements of Statistical Learning (2nd ed.), Springer, 2017 (corrected printing). 9. Bradley E., Trevor H. Computer Age Statistical Inference, Cambridge University Press, 2016. 10. David W.S. Multivariate Density Estimation: Theory, Practice, and Visualization (2nd ed.), Wiley, 2015. 11. Peter McCullagh, John A. Nelder. Generalized Linear Models (2nd ed.), CRC Press, 2019. 12. Gareth J., Daniela W., Trevor H., Robert T. An Introduction to Statistical Learning (2nd ed.), Springer, 2021. 13. Jun Sh. Mathematical Statistics (2nd ed.), Springer, 2003. 14. Ross S.M. Introduction to Probability and Statistics for Engineers and Scientists (6th ed.), Academic Press, 2020.

Module Title	TRP 5303 Theory of random processes (in English)
Semester(s) of Instruction	2
Instructor Responsible	Nugayeva Z. T., PhD, Associate Professor
Language of Instruction	English
Curriculum Association	Profile discipline (PD), elective component (EC)
Modes of Instruction	Lectures, practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 120 h. Contact hours: 40 h. (20 h. of lectures, 20 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 20 h. of MSIWT, 60 h. of MSIW
ECTS	4
Prerequisites (Mandatory and Recommended)	mathematical analysis on manifolds and stochastic analysis
Module Objectives / Expected Learning Outcomes	The discipline "Theory of Random Processes" is a logical continuation of the classic course "Probability Theory and Mathematical Statistics", which forms the basic, fundamental concepts for studying the course. The purpose of the discipline is to prepare students in the field of basic mathematical and natural science knowledge, advanced professional education, which allows graduates to successfully work in their chosen field of activity, possess universal and subject-specialized competencies. Learning outcomes: A) know the purpose, content and main stages of the analysis of stochastic processes and economic models based on them; know the theoretical foundations and be able to use the main methods of integrating stochastic processes; B) be able to calculate the covariance function of a stochastic process; use mathematical tools to study the convergence of a random sequence in root-mean-square, point-by-point, probability and distribution; apply the one-dimensional and two-dimensional Ito formula and replace the variable; solve stochastic differential equations or reduce them to equations of mathematical physics; C) Master the basic analytical techniques of probabilistic and statistical analysis; methods of conducting probabilistic calculations, skills in calculating the main characteristics that arise when conducting probabilistic analysis in practical problems; D) ability to master the culture of thinking, ability to generalize, analyze, perceive information, set goals and choose ways to achieve it; E) ability to use the basic laws of natural science disciplines in professional activities, apply methods of mathematical analysis and modeling, theoretical and experimental research.
Content	Basic concepts of probability theory. Probability space. Algebra and σ-algebra of events. Measurable spaces. Kolmogorov's axiomatics. Measurable mappings and random variables. Distributions of random variables, their mathematical expectation and variance. Random function and random process. Methods for setting a random process. One-dimensional and finite-dimensional distribution functions of a random process. Classification of random processes. Mathematical expectation, variance, and correlation function of a random process. Correlation function and its properties. Correlation function of multidimensional random processes. The main classes of random processes are stationary random processes. Processes with independent increments. Poisson process as a special case of a process with independent increments. Implementations of the Poisson process. Wiener random process. Implementation of the Wiener process. Properties of the Wiener process. Markov random processes. Markov property. Continuity and differentiability of random processes. Stochastic integral of a non-random function. Stochastic integral of Ito. Stochastic differential.
Examination Format	Essay
Learning and Examination Requirements	Study of the materials offered on the UNIVER database and timely completion of tasks according to the schedule of assignments for the course and DEADLINES.

List of literature	1. Gikhman I.I., Skolnik A.V. Introduction to the Theory of Stochastic Processes, Nauka, 1977 2. Korablyov N.I. Theory of Stochastic Processes, MSU, 2019 3. Belyaev Y.K. Introduction to the Theory of Stochastic Processes, Fizmatlit, 2002 4. Shiryaev A.N. Probability (Sections on Processes), MTSNMO, 2016 5. Ross Sh.M. Introduction to Probability Models (12th ed.), Academic Press, 2019 6. Samuel K., Howard T. A First Course in Stochastic Processes, Academic Press, 1975 7. Rick D. Stochastic Processes, Cambridge University Press, 2016 8. Erhan C. Probability and Stochastics, Springer, 2011 9. Bernt O. Stochastic Differential Equations: An Introduction with Applications, Springer, 2020

Module 5.1. – Theory of oscillations

Module Title	EMTMFO 6304 Elements of the mathematical theory of multi-frequency oscillations (in Kazakh)
Semester(s) of Instruction	3
Instructor Responsible	Sartabanov Zh., Professor of the Department of Mathematics
Language of Instruction	Kazakh
Curriculum Association	Profile discipline (PD), university component (UC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Almost periodic functions and their applications, Multi-period solutions of integro-differential equations, Differential equations, mathematical physics and numerical methods for their solution.
Module Objectives / Expected Learning Outcomes	The aim of the course is to study differential equations in both ordinary and partial derivatives in the multidimensional case, to establish the periodicity of solutions of linear and nonlinear differential equations, to successfully master the main results of the above-mentioned theories so that they can later use them effectively in the course of their future scientific and practical activities. Learning outcomes. Knowledge and Understanding: Demonstrate knowledge and understanding of the theory of differential equations, periodic oscillations, and functions. Application: Can apply knowledge, understanding and ability to solve problems in oscillatory solutions of differential systems with multidimensional time. Analysis: Can clearly communicate their findings and knowledge and their rationale to non-specialists. Synthesis: Can integrate knowledge, deal with complex questions, and make judgments based on oscillatory solutions of multidimensional time differential systems. Assessment: They can continue their studies independently.
Content	The role and significance of this discipline in training highly qualified specialists in mathematics lie in the fact that, at the current stage of development in mathematical science, its methods and achievements in algebra, analysis, and probability theory are increasingly used in various fields. Therefore, familiarizing undergraduates with the mathematical foundations of this discipline is a necessary requirement for training highly qualified experts in this scientific direction. In solving many problems in modern science and technology, it is often necessary to deal with oscillatory processes described by both ordinary and partial differential equations. In this regard, the study of oscillatory processes described by differential equations is of exceptional theoretical and applied importance and attracts the close attention of many researchers.
Examination Format	Oral
Learning and Examination Requirements	The final assessment takes place in the format of an exam. The exam is conducted in accordance with the university's academic integrity policy and exam rules. If plagiarism or cheating is detected, the exam results are automatically canceled, and the discipline will be retaken in the summer semester. Form of final control (exam): traditional (exam card-oral, tasks and examples). Exam questions in the discipline – 100. The ticket consists of two questions: the first question corresponds to the theoretical provisions, including the formulation of problems and methods of solution; the second question corresponds to the application (appendix). The results of the exam are entered by the teacher in an electronic form in the "Platonus" system.

List of literature	1. Nysambaev J. Differential Equations 2016. 2. Sagyndykov, B.Zh. Mathematical Physics Equations: 2014 Rmeb 3. Mirzakulova, A.E. Boundary Value Problems for Differential Equations with Small Parameters: M.Kh. Dauylbaev. 2013. Rmeb. 4. Kulzhumieva A.A., Sartabanov Zh.A. Periodic Solutions of Systems of Differential Equations with Multidimensional Time. Uralsk: RIC ZKGU, 2013. 168 p. 5. Kölekeev K.D. Differential Equations: 2012. 6. Tokybetov Zh.A. Mathematical Physics Equations. 2010.

Module Title	PPVSBSSPDE 6305 Periodic in a part of variables solutions in the broad sense of systems of partial differential equations (in Kazakh)
Semester(s) of Instruction	4
Instructor Responsible	Bekbauova A.U., Ph.D., Associate Professor
Language of Instruction	Kazakh/Russian
Curriculum Association	Profile discipline (PD), Elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Differential equations of independent derivatives of the First Order and their applications (in Russian)
Module Objectives / Expected Learning Outcomes	Training in the use of almost periodic functions and differential equations, development of mathematical culture and skills in working with textbooks. 1.knows the purpose and objectives of the course, understands the meaning of the subject, knows the basic concepts, definitions, properties of the theory of multiperiodic and almost periodic oscillations and is able to work with them. 2.Apply the necessary and sufficient periodicity condition to solve problems. 3.Can use the acquired skills in solving problems. 4.be able to study the found solution for almost periodicity using methods for finding solutions to problems posed for differential equations. 5.be able to work independently with the main methods of finding solutions to given problems; be able to communicate with colleagues and count on their opinions.
Content	The discipline" periodic broad-meaning solutions of systems of differential equations of independent origin by part of variables " is considered an integral part of mathematical knowledge of the scientific direction. Knowledge of actual problems of the theory of almost periodic oscillations; mastering the methods of the theory of differential equations describing the laws of various physical phenomena; learning methods for finding solutions to problems posed for differential equations of independent origin, as well as studying the solution to periodicity and developing the skills of finding solutions to the corresponding problems; to develop skills and learn to creatively apply research methods to solve the corresponding problems posed for differential equations.
Examination Format	Written (ticket)
Learning and Examination Requirements	Mandatory attendance of online and classroom classes, active participation in the discussion of issues, preliminary preparation for lectures and practical exercises, high-quality and timely fulfillment of SRO tasks, participation in all types of control.

List of literature	1. Nysambaev J. Differential Equations, 2016. 2. Shaldanbaev, A. Sh. Practical Course in Linear Differential Operators, 2018. 3. Ashirbaev, N. K. Simple Differential Equations, 2014. 4. Bekbayeva A.U. Multi-periodic Solutions in the Broad Sense for Systems of Partial Differential Equations, Aktobe, 2020. 5. Demidovich B.P. Differential Equations: A Textbook for Universities / B.P. Demidovich, V.P. Modenov. – 2nd ed., revised. – St. Petersburg: Lan, 2012. – 288 p. 6. Filippov, A.F. Problem Collection on Differential Equations / A.F. Filippov. – Izhevsk: NIC "RHD", 2012. – 176 p.

Module 5.2. - Almost periodic functions and multi-frequency oscillations

Module Title	EMTMFO 6304 Elements of the mathematical theory of multi-frequency oscillations (in Kazakh)
Semester(s) of Instruction	3
Instructor Responsible	Sartabanov Zh., Professor of the Department of Mathematics
Language of Instruction	Kazakh
Curriculum Association	Profile discipline (PD), university component (UC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Almost periodic functions and their applications, Multi-period solutions of integro-differential equations, Differential equations, mathematical physics and numerical methods for their solution.
Module Objectives / Expected Learning Outcomes	The aim of the course is to study differential equations in both ordinary and partial derivatives in the multidimensional case, to establish the periodicity of solutions of linear and nonlinear differential equations; to successfully master the main results of the above-mentioned theories so that they can later use them effectively in the course of their future scientific and practical activities. Learning outcomes: Knowledge and Understanding: Demonstrate knowledge and understanding of the theory of differential equations, periodic oscillations, and functions. Application: Can apply knowledge, understanding and the ability to solve problems in oscillatory solutions of differential systems with multidimensional time. Analysis: Can clearly communicate their findings, knowledge and their rationale to non-specialists. Synthesis: Can integrate knowledge, deal with complex questions, and make judgments based on oscillatory solutions of multidimensional time differential systems. Assessment: They can continue their studies independently.
Content	The role and significance of this discipline in training highly qualified specialists in mathematics lie in the fact that, at the current stage of development in mathematical science, its methods and achievements in algebra, analysis, and probability theory are increasingly used in various fields. Therefore, familiarizing undergraduates with the mathematical foundations of this discipline is a necessary requirement for training highly qualified experts in this scientific direction. When solving many problems of modern science and technology, it is often necessary to deal with oscillatory processes that are described by differential equations, both ordinary and partial derivatives. In this regard, the study of oscillatory processes described by differential equations is of exceptional theoretical and applied importance and attracts the close attention of many researchers.
Examination Format	Oral
Learning and Examination Requirements	The final assessment takes place in the format of an exam. The exam is conducted in accordance with the university's academic integrity policy and exam rules. If plagiarism or cheating is detected, the exam results are automatically canceled, and the discipline will be retaken in the summer semester. Form of final control (exam): traditional (exam card-oral, tasks and examples). Exam questions in the discipline – 100. The ticket consists of two questions: the first question corresponds to the theoretical provisions, including the formulation of problems and methods of solution; the second question corresponds to the application (appendix). The results of the exam are entered by the teacher in an electronic form in the "Platonus" system.

List of literature	7. Nysambaev J. Differential Equations, 2016. 8. Sagyndykov, B.Zh. Mathematical Physics Equations: 2014, Rmeb. 9. Mirzakulova, A.E. Boundary Value Problems for Integral Differential Equations with Small Parameters: M.Kh. Dauylbaev, 2013, Rmeb. 10. Kulzhumieva A.A., Sartabanov Zh.A. Periodic Solutions of Systems of Differential Equations with Multidimensional Time. Uralsk: RIC ZKGU, 2013. 168 p. 11. Kölekeev K.D. Differential Equations: 2012. 12. Tokybetov Zh.A. Mathematical Physics Equations, 2010.

Module Title	APFA 6305 Almost periodic functions and its applications (in Kazakh)
Semester(s) of Instruction	4
Instructor responsible	Abdikalikova G.A., Professor of the Department of Mathematics
Language of instruction	Kazakh
Curriculum Association	Profile discipline (PD), elective component (EC)
Modes of instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Differential equations, mathematical physics and numerical methods of their solution
Module Objectives / Expected Learning Outcomes	The purpose of the study is to deepen the knowledge of undergraduates on current problems of the theory of periodic, multiperiodic and almost periodic functions and their applications, to demonstrate the ability to use research methods and find multiperiodic and almost periodic solutions to problems of partial differential equations, to study the scientific results of scientists working in this direction, to form a scientific worldview and the education of mathematical culture. Learning outcomes: A) Demonstrate knowledge and understanding about current problems in the theory of partial differential equations, the theory of multiperiodic and almost periodic functions. B) To generate knowledge, understanding and the ability to creatively apply research methods in constructing mathematical models of physical processes and finding periodic and almost periodic solutions to the corresponding problems of differential equations. C) To integrate knowledge, formulate actual problems of partial differential equations, develop methods for finding periodic and almost periodic solutions to problems; the ability in the field of education to creatively apply research methods to almost periodic solutions of relevant problems set for differential equations. D) Communicate their knowledge, conclusions and ideas to the scientific community. To substantiate the implementation and forecasting of research results on multiperiodic and almost periodic solutions of differential equations. E) Continue to study independently on the theory of multiperiodic and almost periodic functions in the priority areas of natural sciences in the context of the growth of information and communication technologies.

Content	Periodic functions. Basic properties of periodic functions. Sinusoidal oscillations. Multiperiodic functions. Basic properties of multiperiodic functions. Almost periodic functions. The fundamental definitions of almost periodic functions by Bohr, Bochner, and others. The criterion of almost periodicity according to Bochner. Basic properties of almost periodic functions. A uniformly converging sequence of almost periodic functions. The derivative and integral of an almost periodic function. The theorem on the average value of an almost periodic function. Properties of the average value of an almost periodic function. The space of an almost periodic function. The Bessel inequality. The Fourier series of an almost periodic function. The Parseval equality. The approximation theorem. Bochner's compactness theorem. A necessary and sufficient condition for the existence and uniqueness of a periodic solution for a linear ordinary differential equation of the first order. Favard's theory. Solvability in the Bezikovich class. Periodic and almost periodic solutions of an ordinary first-order differential equation. Periodic and almost periodic solutions of an ordinary differential equation of the second order. Application of the Poincare periodicity condition for solving ordinary differential equations of the first and second orders and partial differential equations. Multiperiodic and almost periodic solutions of partial differential equations.
Examination format	Written (ticket)
Learning and Examination Requirements	Study of the materials offered on the UNIVER database and timely completion of tasks according to the schedule of assignments for the course and DEADLINES.
List of literature	1. Bohr H. Almost Periodic Functions, URSS, 2021. 2. Levitan B.M. Almost Periodic Functions, GITTL, 1953. 3. Bohr H. Almost Periodic Functions. Chelsea Publishing Company, 1947. 4. Levitan B.M. Almost-Periodic Functions. Holt, Rinehart and Winston, 1966. 5. Levitan B.M., and Zhikov V.V. Almost Periodic Functions and Differential Equations. Cambridge University Press, 1982. 6. Corduneanu C. Almost Periodic Functions, Chelsea Publishing Company, 1989. 7. Amerio L., and Prouse G. Almost-Periodic Functions and Functional Equations. Springer, 1971. 8. Zhang Ch. Pseudo Almost Periodic Functions. Nova Science Publishers, 2003. 9. N'Guérékata Gaston M. Almost Automorphic and Almost Periodic Functions in Abstract Spaces. Kluwer Academic Publishers, 2001. 10. T. Diagana. Almost Periodic Hyperbolic Type Equations. Nova Science Publishers, 2013. 11. Du, Wei-Shih; Kostić, Marko; Pinto, Manuel; Masiello, Antonio. "Almost Periodic Functions and Their Applications: A Survey of Results and Perspectives." Journal of Mathematics, vol. 2021, Article ID 5536018, 21 pages, 2021. https://doi.org/10.1155/2021/5536018

Module 6.1. – Problems of numerical-analytical methods and geometry

Module Title	SGSSNC 6306 Study and graphing of some surfaces of negative curvature (in Kazakh)
Semester(s) of Instruction	3
Instructor Responsible	Kaidasov J., Associate Professor
Language of Instruction	Kazakh
Curriculum Association	Profile discipline (PD), elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	differential geometry, GeoGebra program
Module Objectives / Expected Learning Outcomes	To deepen the knowledge of undergraduates about the theory of surfaces of differential geometry and their applications. Formation of the scientific approach of scientists engaged in this direction. Learn how to draw graphs using some programs in the environment. A. Knowledge and understanding of the actual problems of the theory of negative flexible surfaces of Differential Geometry, learning to creatively apply research methods of the theory of negative flexible surfaces. B. The ability to implement the results of research on The Theory of surfaces and justify forecasting. C. Ability to construct graphs of parameterized surfaces using the Wolfram Mathematica and GeoGebra program. D. To be able to discuss the theorems and concepts, programs and use the constructive in future scientific research, solving problems; E. The ability to competently apply the acquired knowledge and skills and recognize their public essence.
Content	Classification of surfaces by gaussitic (complete) bend in three-dimensional Euclidean space. Some types of negative gausstic flexible surfaces. Pseudospheric surfaces and their relationship with Lobachevsky geometry. In the Wolfram Mathematica environment, using the GeoGebra program, construct graphs of surfaces and some types of negatively flexible surfaces.
Examination Format	Oral
Learning and Examination Requirements	Studying the materials offered on the basis of UNIVER and timely completion of tasks according to the schedule of assignments according to the course and SRO.
List of literature	1. Poznyak E.G., Shikin E.V. Differential Geometry: An Introduction. – Moscow: Moscow University Press, 1990. - 384 p. 2. Pogorelov A.V. Geometry. – Moscow: Prosveshcheniye, 1983. 3. Atanasyan L.S., Bazylev V.T. Geometry. Part II. – Moscow: Prosveshcheniye, 1987. 4. Collection of Problems and Exercises in Differential Geometry (edited by V.T. Vodnev). – Higher School Publishing, Minsk, 1970. 5. Atanasyan L.S., Gurevich G.B. Geometry. Part 2. – Moscow: Prosveshcheniye, 1985. 6. Efimov N.V. Higher Geometry. – Moscow: Nauka, 1993. 7. Kaidasov Zh. Elements of Differential Geometry and Topology – Aktobe, 2004. 8. Baynazarov T.E. "Introduction to GeoGebra" (Methodological Guide). – Astana, 2013.

Module Title	NAMISBVP 6307 Numerical and analytical methods for investigating solutions of boundary value problems (in Russian)
Semester(s) of Instruction	4
Instructor Responsible	Kokotova E.V., Associate Professor of the Department of Mathematics
Language of Instruction	Russian

Curriculum Association	Profile discipline (PD), elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	To master this module, you need the knowledge, skills and abilities acquired during the following courses: "Differential equations, mathematical physics and numerical methods of their solution".
Module Objectives / Expected Learning Outcomes	The aim is to study the problems of the theory of boundary value problems and the application of basic numerical and analytical methods for solving boundary value problems for partial differential equations, equations of mathematical physics. It is expected that after completing the course, undergraduates should 1. to know the relevant problems of numerical and analytical solutions of boundary value problems of differential equations and equations of mathematical physics; 2. understand the principles of constructing numerical algorithms, on the basis of which the most rational strategy for numerical problem solving is implemented, and use knowledge of numerical and analytical methods in practice to solve boundary value problems of differential equations.; 3. be able to apply numerical and analytical research methods to the construction of mathematical models of physical processes and to finding solutions to relevant mathematical problems 4. acquire the skills of independent work with approximate and numerical methods of research and solving problems of mathematical physics equations; 5. be able to find effective algorithms for solving computational mathematics problems.
Content	On the formulation of boundary value problems for partial differential equations. The finite difference method. Basic concepts of the theory of difference schemes. Approximation of the simplest differential operators. Correctness of the difference scheme. The relationship between stability and convergence. Methods for solving grid equations. Difference methods for solving partial differential equations of the first order. The transfer equation. The Godunov method. A mixed boundary value problem for acoustics equations. Difference schemes for the equation of thermal conductivity. Explicit and implicit difference schemes. The run-through method for parabolic type equations. Finite-difference approximation of boundary value problems for hyperbolic type equations. Difference schemes for the wave equation. Fourier series for grid functions. Representation of solutions of difference schemes for the equation of thermal conductivity, for the problem of string vibrations in the form of finite Fourier series. Difference schemes for solving elliptic type equations. The method of straight lines for elliptical type equations, thermal conductivity equations, and the wave equation. A discrete analytical method for solving a mixed boundary value problem for the equation of thermal conductivity, a mixed boundary value problem for the equation of oscillations. Variational methods for solving boundary value problems. The Ritz method.
Examination Format	Project
Learning and Examination Requirements	Students are required to attend all classes according to the schedule; preliminary preparation for classes, study of recommended literature; active participation in lectures, active work in practical classes, timely completion and delivery of independent work and homework assignments; passing all types of control.

List of literature	**Core Reading** 1. Samarskiy A.A., Gulin A.V. Numerical methods of mathematical physics. – Moscow: Scientific World, 2003. 2. Pimenov V. G. Numerical methods: in two parts, Part 2: Textbook. Manual. – Yekaterinburg: Ural Publishing House, University, 2014. –106 p. 3. Kireev V. I., Panteleev A.V. Numerical methods in examples and problems: A textbook. – St. Petersburg: Lan Publishing House, 2015. 4. Elfimova E.A., Dobroserdova A.B., Solovyova A.Yu. and others. Mathematical modeling of oscillatory processes: problem formulation and methods for solving hyperbolic differential equations : textbook; under the general editorship of E.A. Elfimova. –Yekaterinburg : Ural Publishing House. University, 2024. – 264 p. 5. Samarskiy A. A. Theory of difference schemes: textbook. manual / A. A. Samarskiy. –Moscow: Nauka, 1989. 6. Shalabaeva B.S., Syzdykova 3.N. Numerical methods: A textbook. – Almaty: Technoerudit, 2018. –168 p. 7. Mezentsev A.V., Yagupov S. A. Analytical and numerical methods for solving equations of mathematical physics : textbook. Stipend. – Yekaterinburg: UrGUPS, 2017. 8. Kalitkin N. N., Koryakin P. V. Numerical methods : in 2 books. Book 2. Methods of mathematical physics : textbook for students. institutions of higher Prof. –Moscow : Akademiya Publishing Center, 2013. 304 p . 9. Koltsova E. M., Skichko A.S., Zhensa A.V. Numerical methods for solving equations of mathematical physics and chemistry: a textbook for universities. – Moscow : Yurayt Publishing House, 2024. 10. Panferov A.A. Analytical and numerical solution of partial differential equations. –Tolyatti: Tolyatti State University Press, 2014. 11. Grinyaev Yu.V. M. Methods of mathematical physics : a textbook / Yu. V. Grinyaev, L. L. Minkov, S. V. Timchenko, V. M. Ushakov. –Tomsk : El Content, 2012. –148 p. 12. Ryndin E. A., Kulikova I. V., Lysenko I. E. Methods of numerical solution of mathematical physics problems: A textbook. –Taganrog: SFU Publishing House, 2014. –179 p. 13. Gulevich D.R., Zalipaev V.V., Numerical methods in Physics and Engineering – St. Petersburg: ITMO University, 2020. 14. Numerical methods: textbook.The method. stipend. in two parts, Part 1/ V. M. Volkov. –Minsk: BSU, 2016. Supplementary Reading 15. Tikhonov A.N., Samarskiy A.A. Equations of mathematical physics. – Moscow: MSU Publishing House, 2004. 16. Godunov S. K., V. C. Ryabenky. Difference schemes (an introduction to theory). – Moscow: Nauka, 1977. 17. Samarsky A. A. Tasks and exercises on numerical methods / A. A. Samarsky, P. N. Vabishevich, E. A. Samarskaya. – Moscow: Kom Kniga, 2007. – 207 p . 18. Computer science in construction (with the basics of mathematical and computer modeling): a textbook / collective authors edited by P.A. Akimov. – Moscow : KNORUS, 2017. – 420 p .

19. Demidovich B.P., Maron I.A., Shuvalova E.Z. Numerical methods of analysis. Approximation of functions, differential and integral equations. –Moscow: Nauka, 1967.
20. Vlasova, E. A. Approximate methods of mathematical physics : textbook / E. A. Vlasova, B. C. Zarubin, G. N. Kuvyrkin ; edited by B. C. Zarubin, A. P. Krishchenko. — 2nd ed., stereotype. Moscow: Bauman Moscow State Technical University, 2004— 704.
21. Kolesnikova S.I. Methods for solving basic problems of equations of mathematical physics. Textbook. Moscow: MIPT, 2015.
22. Abdikalikova G.A., Berzhanov A.B. Problems in mathematical physics equations. The training manual. –Aktobe: Litera-A, 2007.
23. Zenkov A.V. Numerical methods: textbook. Manual. – Yekaterinburg: Ed. The Urals. University, 2016. –124 p.
24. Pikulin V.P., Samobodaev S.I. A practical course in mathematical physics equations. – Moscow: 2004.
25. Borzenkov, A.V. Partial differential equations. MATLAB: lecture notes for students. all specials. BGUIR day. forms of education / A. V. Borzenkov. – Minsk : BGUIR, 2009. – 120 p.

Electronic resources

1. Numerical Solution of Mathematical Physics Equations in the Mathcad Integrated Environment [Electronic Resource]: Methodological Guidelines for Laboratory Work in the Discipline "Special Sections of Higher Mathematics"; Compiled by N.A. Mikhailova. Volgograd: VolgGASU, 2012. The official website of Volgograd State University of Architecture and Civil Engineering. Access Mode: http://www.vgasu.ru/publishing/on-line/ – Title page, screen.
2. Setukha, A.V. The Method of Integral Equations in Mathematical Physics: A Textbook. – Moscow: Moscow University Press, 2023. 316 p. – Electronic Edition for Network Distribution – (Library of the Faculty of Moscow State University) https://msupress.com/ebook/978-5-19-011045-9_e-book.pdf
3. EqWorld Scientific and Educational Website. https://eqworld.ipmnet.ru/indexr.htm
4. Scientific and Educational Website of MechMath. https://mechmath.ipmnet.ru/lib/?s=numerics

Module 6.2. - Applications of boundary value problems and methods of probability theory

Module Title	TPAPA 6306 Theoretical probabilistic approach to the problems of analysis (in Kazakh)
Instructor Responsible	Utesov A. B., Candidate of Physical and MathematicalSciences, Associate Professor
Language of Instruction	Kazakh
Curriculum Association	Profile discipline (PD), elective component (EC)
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	mathematical analysis, differential equations, functional analysis, probability theory and mathematical statistics
Module Objectives / Expected Learning Outcomes	In this course, functional-theoretic and probability-theoretic methods of integration and reconstruction from finite numerical information are compared in the same terms, and methods for constructing probability measures on classes of functions are studied. Learning outcomes: A) knows the formulation of problems of approximation theories on the average; B) formulates the main points of the probability-theoretic approach to analysis problems; C) is able to solve problems of constructing probabilistic measures on specific functional classes; D) on the basis of the acquired knowledge is able to build optimal computational aggregates in problems of integration and restoration of functions on functional classes; F) on the basis of the acquired knowledge, it is able to build optimal computational aggregates in problems of discretization of solutions to partial differential equations based on finite information obtained from initial, boundary or boundary conditions.
Content	Basic concepts of probability theory. Probability space. Measurable spaces. Kolmogorov's axiomatics. Measurable mappings and random variables. Distributions of random variables, their mathematical expectation and variance. Average load of the computational integration unit. Average errors of the Monte Carlo integration method. Construction of probability measures on function classes. Average errors of deterministic data quadrature formulas. Discretization of solutions of partial differential equations on average.
Examination Format	Oral
Learning and Examination Requirements	Studying the materials offered on the basis of UNIVER and timely completion of tasks according to the schedule of assignments according to the course and SRO.

List of literature	1. Temirgaliev, N. On the Construction of Probability Measures on Functional Classes // Proceedings of the Steklov Institute of Mathematics, Russian Academy of Sciences, 1997, Vol. 218, pp. 397–402. 2. Temirgaliev, N. Computational Cross-Section. Algebraic Number Theory and Harmonic Analysis in Reconstruction Problems (Quasi-Monte Carlo Method). Embedding and Approximation Theory. Fourier Series. Special Issue Dedicated to the Scientific Achievements of Mathematicians of L.N. Gumilyov Eurasian National University. Bulletin of L.N. Gumilyov ENU, 2010, pp. 1–194. 3. Voronin, S.M., Temirgaliev, N. On an Application of the Banach Measure to Quadrature Formulas // Mathematical Notes, 1986, Vol. 39, No. 1, pp. 52–59. 4. Pytyev, Yu.P., Shishmarev, I.A. Probability Theory, Mathematical Statistics, and Elements of Possibility Theory for Physicists, 2010, Faculty of Physics, Moscow State University. 5. Serdobolskaya, M.L., Chulichkov, A.I. Problem-Solving Guide in Probability Theory, 2018, Faculty of Physics, Moscow State University. 6. Khalafyan, A.A., Borovikov, V.P., Kalaydina, G.V. Probability Theory, Mathematical Statistics, and Data Analysis: Theoretical Foundations and Computer-Based Practice. STATISTICA. EXCEL. Over 150 Solved Examples, 2017, URSS. 7. Pyrkina, O.E. Probability Theory and Mathematical Statistics for Use in Data Analysis, 2023, Prometheus.

Module Title	NBVPMPhEA 6307 Non-local boundary value problems of mathematical physics equations and its applications (in Russian)
Semester(s) of Instruction	4
Instructor Responsible	Abdikalikova G.A., Professor of the Department of Mathematics
Language of Instruction	Russian
Curriculum Association	Profile discipline, elective component
Modes of Instruction	Lectures, Practical Lessons, MSIWT/Master Students' Independent Work with Teacher, MSIW/Master Students' Independent Work
Workload (Including Contact Hours and Independent Study)	Total hours: 150 h. Contact hours: 45 h. (15 h. of lectures, 30 h. of practical lessons) Students' Self-study work, including, preparing for Exams, in hours: 25 h. of MSIWT, 80 h. of MSIW
ECTS	5
Prerequisites (Mandatory and Recommended)	Mathematical analysis on manifolds and stochastic analysis, differential equations, mathematical physics and numerical methods for their solution.

Module Objectives / Expected Learning Outcomes	The purpose of training is to deepen knowledge and familiarize undergraduates with current problems in the theory of non-local boundary value problems for mathematical physics equations, teach undergraduates basic methods for studying and solving boundary value problems for some mathematical physics equations, develop the ability to design effective algorithms for solving problems to form a scientific worldview and foster a mathematical culture. Learning outcomes: A) Demonstrate knowledge and understanding of current problems in the theory of nonlocal boundary value problems for equations of mathematical physics. B) Generate knowledge, understanding, and creative application of research methods in constructing mathematical models of physical processes and finding solutions to non-local boundary value problems. C) Integrate knowledge, formulate actual problems of boundary value problems with non-local conditions for equations of mathematical physics, develop principles and approaches for studying boundary value problems with non-local conditions. D) Communicate their knowledge, conclusions and ideas to the scientific community; justify the implementation and prediction of the obtained research results on the theory of non-local boundary value problems for equations of mathematical physics. F) Continue to study independently in the priority areas of mathematical physics problems in the context of the growth of information and communication technologies. In the field of training – the ability to analyze problems of non-local problems of mathematical physics equations.
Content	Differential equations and boundary value problems. Statement of boundary value problems for a partial differential equations and their physical interpretation. A necessary and sufficient condition for the existence and uniqueness of the solution of a two-point boundary value problem for partial differential equations. Unique solvability of a boundary value problem with a non-local condition for a linear equation of hyperbolic type. Algorithm for finding a solution to a non-local boundary value problem for a linear equation of hyperbolic type by parameterization. Correct solvability of a non-local boundary value problem for a first-order hyperbolic linear equation. Necessary and sufficient coefficient conditions for the existence and uniqueness of the solution of a non-local boundary value problem for a first-order hyperbolic equation. Iterative methods for constructing solutions to boundary value problems with a non-local condition for a system of partial differential equations. Solvability of non-local boundary value problems for mathematical physics equations in a broad sense.
Examination Format	Essay
Learning and Examination Requirements	Study of the materials offered on the UNIVER database and timely completion of tasks according to the schedule of assignments for the course and DEADLINES.

List of literature	1. Nakhushev, A. M. Nonlocal Boundary Value Problems and Their Applications, 1995, Nauka. 2. Nakhushev, A. M. Nonlocal Problems of Mathematical Physics, 2002, Fizmatlit. 3. Kipriyanov, I. A. Partial Differential Equations: Methods of Nonlocal Analysis, 2000, Fizmatlit. 4. Arutyunyan, R. M., Arutyunyan, A. M. Nonlocal Boundary Value Problems and Methods of Their Solution, 2021, Lan. 5. Petrosyan, L. A., Mnatsakanyan, G. N. Nonlocal Problems of Mathematical Physics: Formulation, Solution, Applications, 2018, Yerevan State University. 6. Kolesnikov, A. A. Nonlocal Boundary Value Problems in Technical Physics Models, 2017, Ural Federal University. 7. Bekhter, N. P. Nonlocal Boundary Value Problems for Equations of Mathematical Physics, 2003, Nauka. 8. Lavrentyev, M. M., Shabat, B. V. Methods of the Theory of Functions of a Complex Variable and Nonlocal Problems, 1987, Nauka. 9. Urmurzina, M. Kh. Nonlocal Boundary Value Problems for Equations with Fractional Derivatives, 2016, Ufa Federal Research Center. 10. Samarsky, A. A., Popov, Yu. P. Differential Equations of Mathematical Physics, 1975 (and reprints), Nauka. 11. Gladkovskaya, R. P. Nonlocal Boundary Value Problems for Parabolic Equations, 2012, Ural Federal University. 12. Sharanda, Yu. I. Nonlocal Problems for Equations with Degenerate Structure, 2015, Institute of Mathematics SB RAS.