MODULE HANDBOOK

EP MA 7M05301 – Physics (IP)

Aktobe, 2025

Content

Module title	IFN 5201 History and philosophy of science
Semester	1
Responsible Instructor	Sarsembin U.K.
Language of Instruction	Kazakh
Correlation with the curriculum	Required component
Forms of Instruction	Lectures, practice, Independent work
Student Workload (including contact hours and SWS)	Total workload: 90 h. Contact hours: 30 (15 h lecture, 15 h practise) Independent work: 30 SIWT, 30 SIW
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	To study the course "History and Philosophy of Science," the graduate student should have prior knowledge of the history and theory of philosophy, humanities, natural sciences, and specialized subjects.
Module objectives/intended learning outcomes	To facilitate the formation of learners as future professionals and scientists. The course aims to explain the history and philosophy of science, its role in societal development, and its connection with social institutions and each other. It focuses on developing the ability to deeply analyze the key issues of contemporary philosophy of science, the state policy in science development, and the major challenges faced by society.
Form of Examination	The philosophy of science and its formation, the primary object of study. Fundamental ideas of the philosophy of science, types of science, and stages of development. The role of science in society and its function as a social institution. The relationship between science and philosophy. Key categories of the philosophy of science, scientific research, the fundamental structure and methods of scientific cognition, and the characteristics of modern science. The role of science as a social institution and a profession within society. Types and developmental directions of modern science, types and development of science in Kazakhstan, and the state policy on science development.
Requirements for Study and Examinations	Written
References	Full comprehension of the course topics, thorough familiarity with relevant literature, understanding the relevance and uniqueness of each topic, and in-depth knowledge of the history of science, scientific cognition, and research methods.
Form of Examination	**Main References:** 1. Kenny, A. *Ancient Philosophy*. – Almaty: National Translation Bureau, 2018. – 364 p. 2. Johnston, D. *A Brief History of Philosophy*. – Almaty: National Translation Bureau, 2018. – 224 p. 3. Kenny, A. *Medieval Philosophy*. – Almaty: National Translation Bureau, 2018. – 352 p. 4. Hess, R. *25 Most Influential Books in Philosophy*. – Almaty: National Translation Bureau, 2018. – 368 p. 5. Ryskaliev, T.Kh. *Overview of the History of Philosophy: A Study Guide*. – Oral: Dastan, 2005. – 382 p. 6. Abai. *The Book of Words. Poems*. – Almaty, 1993. – 272 p. 7. *World Philosophical Heritage*, Vol. 4: *The Philosophy of Al-Farabi and Ibn Sina*. – Almaty: Zhazushy, 2005. – 568 p. 8. *Western Philosophy: A Study Guide*. – Almaty: Zhazushy, 2009. – 480 p. 9. Nysanbayev, A. *History and Philosophy of Science: A Study Guide*. – Almaty: Evero Publishing, 2013. 10. Dukenbayeva, Z.O., Talgatbek, M.M. *Al-Farabi and Al-Mashani: Spiritual Continuity. Scientific Edition*. – Almaty, 2017.

	11. Abishev, K. *Philosophy: Textbook for Students and Master's Degree Students*. – Almaty, 2000. 12. Asarov, A. *Philosophy of Science: A Terminological Dictionary*. – Almaty: Medet Group, 2021. – 122 p. **Additional References:** 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 Informational Reality*. – Moscow, 2007. 4. Kazyutinsky, V.V. *Global Evolutionism and the Scientific Picture of the World* // *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*. – Alma-Ata, 1992. 7. Lektorsky, V.A. *Classical and Non-Classical Epistemology*. – Moscow, 2006. 8. Mukashev, Z.A. *Concepts of Modern Natural Science*. – Almaty, 2005. **Scientific Libraries of Kazakhstan:** 1. Kazakhstan National Electronic Library – 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 the "Gylym Ordasy" under the Committee of Science of the Ministry of Education and Science of the Republic of Kazakhstan – http://www.library.kz 5. Russian Scientific Network – an information system aimed at facilitating access to scientific, popular science, and educational resources – http://nature.web.ru

Module title	Pedagogy of Higher Education
Semester	1
Responsible Instructor	Ramazanova Dinara, PhD
Language of Instruction	Russian, Kazakh languages
Correlation with the curriculum	Required component
Forms of Instruction	CER, MOOC, etc.
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 30 hours, SIWT – 15 hours, SIW – 45 hours (lecture, lesson, project, seminar etc.) / 90 hours
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: In order to master the "Pedagogy" course in depth, students will build on their previously acquired professional knowledge, skills, and abilities in the fields of philosophy, general pedagogy, and general psychology at the bachelor's level.
Module objectives/intended learning outcomes	**Module objective:** To teach undergraduates the basic professional and pedagogical culture and to arm future teachers with the theoretical and methodological foundations of higher school pedagogy, to introduce them to modern technologies for planning and organizing teaching and education, and to the communication technology of teacher-student interaction in the educational process of higher education. **Learning outcomes:** A) to acquire new knowledge in the field of physics, using modern educational technologies; B) to know languages in spheres of social and scientific communication; to be capable to continue training and to conduct professional activity in the foreign-language environment; C) knowledge of the entire pedagogical process in higher education institutions, a system of professional knowledge and understanding of its structure, content, forms and methods of teaching, tools, and new pedagogical technologies of teaching;

	D) Has high skills and techniques in personal and professional activities, is able to use media education technologies, and has mastered the ability to manage the socialization process and emotional intelligence of the individual; E) Formation of a competent specialist who has a comprehensive and deep understanding of national values in the development of human capital, who can adhere to the continuity of classical innovative foundations in pedagogy and psychology; Ensuring the training of specialists with a high communicative culture, who have developed the skills to use innovative (ICT) technologies in the management of education and upbringing.
Content	The discipline is aimed at mastering the patterns and principles of training, means and methods of higher professional education, and examining theoretical and practical problems of higher professional education. In the course of mastering the discipline, students acquire a deep understanding of the key tasks of the higher education system of the Republic of Kazakhstan, develop skills in managing the pedagogical process using modern pedagogical technologies.
Form of Examination	Written
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the total rating based on the results of the 1st and 2nd midterm tests are allowed to take the final exam
References	**Main references:** 1. Shalgynbayeva, K.K., Albytova, N.P., & Slambekova, T.S. *Pedagogy of Higher Education: A Study Guide*. – Almaty: SSK, 2017. – 272 p. https://rmebrk.kz/book/1170382 2. Beetham, H. *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning*. – Almaty: National Translation Bureau, 2019. – 328 p. https://rmebrk.kz/book/1171570 3. Myngbayeva, A.K., Aitbayeva, A.B., & Kudaibergenova, A.M. *Fundamentals of Higher Education Pedagogy: A Study Guide*. – Almaty: Kazakh University, 2016. – 236 p. https://rmebrk.kz/book/1175282 4. Akbayeva, L.K., & Akbayeva, A.N. *Pedagogy and Psychology of Higher Education: Methodological Guidelines for Seminar Sessions for Master's Students*. – Almaty: KazGASA, 2012. – 49 p. https://rmebrk.kz/book/1105614 5. Nagymzhanova, K.M., Duisembinova, R.K., & Kulzhabayeva, L.S. *Modern Global Higher Education System: Lecture Collection*. – Nur-Sultan: Publishing House of Turan-Astana University, 2019. – 138 p. https://rmebrk.kz/book/1179895 6. Zhumatayeva, E. *Didactics of Higher Education: Monograph*. – Pavlodar: ECO, 2006. – 316 p. https://rmebrk.kz/book/1165854 7. Zhumatayeva, E. *The Practice of Using Educational Technologies in Higher Education* // Bulletin of S. Toraighyrov Pavlodar State University. Pedagogical Series, 2008, No. 1. https://rmebrk.kz/book/15206 8. Kasymbayeva, G.N. *Effective Methods of Using Interactive Teaching Techniques in Higher Education* // The Role and Place of Young Scientists in Promoting Kazakhstan's New Economic Policy: Proceedings of the Satpayev International Readings. – Almaty: Kazakhstan, 2015. – Vol. 1. – P. 547–550. https://rmebrk.kz/book/1152143 9. *School Pedagogy: Educational and Methodological Complex (Syllabus)* / Compiled by B.O. Qurbanaliyev. – Zhetisay: Syrdariya University, 2007. – 120 p. https://rmebrk.kz/search/

	10. Kudebayeva, Z.N. *Pedagogy of Higher Education: Test Assignments. A Study Guide* / Taraz State Pedagogical University. – Taraz: Format-Print, 2019. – 124 p. https://rmebrk.kz/search 11. Belykh, A.S. *Pedagogy of Higher Education: Textbook*. – Luhansk: Publishing House of LNU V. Dahl, 2018. – 248 p. http://dot.kostacademy.kz/bible/files/813849436.pdf

Module title	PU 5204 Psyhology of management
Semester	1
Responsible Instructor	Sautenkova M.Yu., candidate of ps.sciences.
Language of Instruction	Russian
Correlation with the curriculum	Required component
Forms of Instruction	Lectures, seminars
Student Workload (including contact hours and SWS)	Total hours – 30 (15 h. of lectures, 15 h. of practise) Independent work: 30/30
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	General Psychology, Developmental Psychology, Psychodiagnostics.
Module objectives/intended learning outcomes	The aim of this course is to explore issues related to the applied field of psychological science, with a particular focus on studying and solving management-related problems based on psychological knowledge and theories. The course helps students, as future professionals in the educational environment, to master the psychology and culture of business communication and management activities. In the process of mastering the course, special attention is paid to developing students' leadership, managerial, and reflective qualities in the field of educational management, involving them in scientific activities, enhancing their leadership abilities and professional competencies, and developing management methods, such as: A) Understanding the essence and psychological characteristics of management functions; B) The ability to independently search for, critically analyze, organize, and summarize scientific and psychological information; C) The ability to manage a team and to tolerate social and psychological differences; D) The ability to design, implement, and evaluate the educational process and environment in higher education institutions during the training of psychological personnel; E) Recognizing the importance of using creative potential for self-development and self-actualization.
Content	The course explores the laws, principles, and methods underlying the structure and functioning of organizations; the principles and laws that form the basis of managerial activity in organizational leadership; the nature of managers' engagement in organizational management; and the personal (physiological, psychological, and social) needs that a manager must satisfy.
Form of Examination	Written (essay)
Requirements for Study and Examinations	
References	Main references 1. Konovalenko, V. A., Konovalenko, M. Yu., & Solomatin, A. A. *Personnel Management Psychology: Textbook for Academic Bachelor's Degree.* Moscow: Yurayt Publishing, 2015. – 477 p. – (Series: Bachelor. Academic Course). 2. Mambetalina, A. S. *HR Personnel Management.* Nur-Sultan: L. Gumilyov ENU, 2021. – 145 p. 3. Maltseva, Yu. A., & Yatsenko, O. Yu. *Management Psychology.* Yekaterinburg: Ural University Press, 2016. – 92 p.

	4. Alieva, M. B., Magomedova, E. E., Radzhabova, R. V., Umarieva, S. Z., & Tsakhaeva, A. A. *Management Psychology: Study Guide.* Kyiv, 2017. 5. Vesnin, V. R. *Fundamentals of Management: Textbook.* Moscow: Prospekt, 2010. – 97 p. 6. Ostrovskiy, E. V. *Management Psychology: Study Guide.* Moscow: INFRA-M, 2011. – 249 p. [Online access: http://znanium.com/bookread.php?book=313827] 7. Bazarov, T. Yu. *Personnel Management Psychology: Textbook and Practicum for Academic Bachelor's Degree.* Moscow: Yurayt Publishing, 2015. – 381 p. 8. Volkogonova, O. D., & Zub, A. T. *Managerial Psychology.* Moscow: Forum–INFRA-M, 2009. Additional References 9. Avdeev, V. V. *Personnel Management. Optimization of Teamwork: Reengineering Technology: Practicum.* Moscow: FiS, 2008. – 256 p. 10. Morozyuk, S. N. *Personality Psychology. Character Psychology: Textbook for Universities.* Moscow: Yurayt Publishing, 2024. – 217 p. – (Higher Education). – ISBN 978-5-534-06609-8. [Available at Yurayt Educational Platform: https://urait.ru/bcode/540621] 11. Ivanova, V. S. *Management Psychology: Study Guide.* Tomsk: Tomsk Polytechnic University Press, 2011. Internet Resources 1. https://www.inter-nauka.com/uploads/public/15058901949362.pdf 2. Russian State Library Dissertation eLibrary: http://diss.rsl.ru/ 3. LitRes Electronic Library: http://biblio.litres.ru

Module title	**Foreign language (professional)**
Semester	1
Responsible Instructor	Yerzhanova G.A. PhD., Associate Professor
Language of Instruction	English language
Correlation with the curriculum	Required component
Forms of Instruction	CER, MOOC, etc.
Student Workload (including contact hours and SWS)	practical classes – 30 hours, SIWT – 15 hours, SIW – 45 hours (lecture, lesson, labworks, project, seminar etc.) / 90 hours
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: English language (level B1)
Module objectives/intended learning outcomes	**Module objective:** 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. **Learning outcomes:**
Content	**Language as the mirror of culture. Education and Technology. People in science. My master's degree work. Spheres of communication. Social sphere of communication**
Form of Examination	Written
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the total rating based on the results of the 1st and 2nd midterm tests are allowed to take the final exam
References	1. Abdrakhmanova, T.M. *Professionally Oriented English Language: Educational and Methodological Guide*. – Almaty: CyberSmith, 2019. – 108 p. https://elib.kz/

	2. Harrison, R., Pathare, G., & May, P. *Headway: Academic Skills. IELTS Study Skills Edition*. – Oxford: Oxford University Press, 2013. – 240 p. https://ps.ua1lib.org/book/3297727/3df467?dsource=recommend 3. Aleshugina, E.A., Kryukova, G.K., & Loshkaryova, D.A. *Professionally Oriented English for Master's Students: Textbook for Universities*. – Nizhny Novgorod: Nizhny Novgorod State University of Architecture and Civil Engineering, 2016. – 95 p. ISBN 978-5-528-00113-5 https://pnu.edu.ru/ru/faculties/full_time/ffpmk/eng/e-lib/ 4. Kalinichenko, E.B., & Romanova, O.V. (Compilers). *English for Science: Educational and Methodological Manual for Master's Students*. – Saratov, 2016. – 75 p. http://www.sgau.ru/files/pages/21056/14702970647.pdf

Module title	OPNI 5205 Organization and Planning of Scientific Research
Semester	1
Responsible Instructor	Isimov A.M.
Language of Instruction	English
Correlation with the curriculum	University Component (UC) in the cycle of basic disciplines (BD)
Forms of Instruction	Lectures, practical classes, SIWT, SIW
Student Workload (including contact hours and SWS)	Total Workload: 90 hours Contact Hours: 30 hours (15 hours of lectures, 15 hours of practical classes) Independent Study: 60 hours (30 hours of SIWT, 30 hours of SIW, including exam preparation)
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	Undergraduate discipline
Module objectives/intended learning outcomes	The purpose research methodology is to help students who have mastered the research skills and oral presentation in developing a scientific project.
Content	The subject content enhances knowledge of research methodology, R&D, research components, preparation of copyright documents, innovative research plan, project's life cycle and its cost estimation, criteria for selecting ideas and determining quality. It also fosters the acquisition of practical skills for conducting research. The subject facilitates the development of essential skills and abilities for the effective use of artificial intelligence as an additional resource in research that expands learners' research capabilities
Form of Examination	essay
Requirements for Study and Examinations	A. To apply knowledge at a professional level, understand and demonstrate elements of advanced knowledge in one's field, demonstrate knowledge and understanding research methodology; B. Compilation of conclusions and problem solving, problems in the field, data collection and implementing information to form scientific judgments; C. To classify lectures and scientific concepts, to apply the basic knowledge within theoretical and applied linguistics framework in research and professional direction; D. Ability to conduct scientific analysis, write essays, plan, and use qualitative and quantitative methods in humanitarian research; E. To evaluate the importance of the course material and relevance of conclusions, quickly find, analyze and contextually competently process scientific and technical, natural science and general scientific information in accordance with problematic issues.
References	**Main References:** 1. Dinaeva, B.B., Sapina, S.M. *Theoretical and Practical Foundations of Academic Literacy*. – Astana: KazGUU Consulting LLP, 2016. – 164 p. 2. Isenova, F.K. *Educational and Methodological Guide for the Discipline "Academic Writing and Reading" (Module 2 "Scientific Orientation")*. – Astana: KazGUU University Publishing House, 2015. – 144 p.

	3. Korotkina, I. *Academic Writing: A Methodological Guide for School Leaders and Education Specialists*. – Lap Lambert Academic Publishing GmbH & Co., Saarbrücken, Germany, 2011. – 179 p. Radaev, V.V. *How to Organize and Present a Research Project: 75 Simple Rules*. – Moscow: State University – Higher School of Economics, INFRA-M, 2001. – 202 p. (Electronic version: http://narod.ru/disk/2882665000/radaev.rar.html) **Additional References:** Booth, W.C., Colomb, G.G., Williams, J.M. *The Craft of Research: Sixteen Lessons for Beginning Authors* / Translated from English by A. Stanislavsky. – Moscow: Flinta: Nauka, 2004. – pp. 51–90. (http://aperlov.narod.ru/ar/posobija.htm) Eco, U. *How to Write a Thesis. Humanities*. Educational and methodological guide. – Moscow: Universitet, 2001. – 240 p. (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 title	**Material science** (in English)
Semester	1
Responsible Instructor	Shugayeva Tilectes Zhalgasovna, PhD
Language of Instruction	Kazakh/Russian/ English
Correlation with the curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Student Workload (including contact hours and SWS)	Total workload: 120 h Contact hours: 45 h (15 h lectures, 30 h practical classes Independent study, including preparation for exams, in hours: 25 h SIWT, 80 h SIW
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	molecular physics, quantum mechanics, condensed matter physics
Module objectives/intended learning outcomes	**Learning objective:** To master the structure, properties, methods of extraction and research of materials. **The intended learning outcomes are:** Classifies modern scientific and practical problems in physics, organizes and conducts research and experimental work in the chosen direction; 2. Creates a system of knowledge obtained during solving real scientific-practical and other physical problems
Content	Materials science is a science that combines basic physics, chemistry, metallurgy, studies the structure, types, and research methods of materials. Chemical compounds, composites, polymers, melts, solutions are all taught within this material science.
Form of Examination	Traditional (ticket)
Requirements for Study and Examinations	- obtaining quality knowledge; - fulfil the teacher's requirements specified in the syllabus; - independently complete all types of work (SIWTassignments, coursework, graduation theses, etc.) and submit them to the teacher on time; - use reliable and trustworthy sources of information; - not to provide their work for cheating other students.

References	1. William D. Callister, JR., David G. Rethwisch. Materials Science and Engineering. –Wiley, 2017. -924 p. 2. N.Zhanturina. Molecular physics. – Aktobe, 2020.- 100 p. 3. Zhanturina N.N. Condensation physics. – Aktobe, 2017. – 105 p. 3. K. Shunkeyev. L/Myasnikova, N. Zhanturina, A.Tilep, Zh.Zinollin. English-Kazakh-Russian Dictionary of Physical Terms.- Aktobe, 2018.-171 p. 4. Yar-Mukhamedova G.Sh., Shunkeyev K.Sh., Zhanturina N.N. Mechfnics. – Almaty: Kazakh University.-132 p. 5. S. Thornton, A. Rex. Modern physics. –University of Virginia. 2013. – 613 p.

EP	7M05301- Physics
Module title	Methods of Teaching Physics in High School" (in Kazakh)
Semester	1
Responsible Instructor	Sagimbayeva Shynar Zhanuzakovna Associate Professor
Language of Instruction	Kazakh languages
Correlation with the curriculum	Required component
Forms of Instruction	PBL
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 15 hours, IWMT – 15 hours, IWM – 45 hours (lecture, seminar etc.) / 90 hours
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: mechanics, molecular physics, electricity and magnetism, optics, physics teaching methodology;
Module objectives/intended learning outcomes	**Module objective:** The goal is to form psychological and pedagogical thinking in undergraduates. **Learning outcomes:** 1. Uses the results for further independent cognitive activity in the field of new methods of higher professional education; 2. Plans fundamental scientific and professional training in the field of physics, masters modern information technologies, including methods of research, processing and storage of scientific information. 3. Evaluates the possibilities and main trends in the development of higher education. 4. Analyzes modern problems of science, contributes to the upbringing of creative aspirations in social development and the education system. 5. Solves any physics problems; knows the methods of their solution; independently compiles the problem. 6. Systematizes and structures information on the development process of the content of higher education: fundamentalization, humanization, regionalization, differentiation, integration.
Content	The subject "Methodology of Teaching Physics in Higher Education" is one of the basic professional disciplines, has a logical and content-methodological relationship with other departments of the Bachelor's degree, provides the master's student with a systematic understanding of the pedagogical process and teaching work at the educational institution, and allows for the structural and content-based formation of pedagogical practice.
Form of Examination	Verbal, prompts
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the total rating based on the results of the 1st and 2nd midterm tests are allowed to take the final exam
References	**Main references:** 1. Organization of educational activities in a university and teaching methods in higher education: a course of lectures / comp. Yu.P. Fedulov - Krasnodar: KubGAU, 2015. - 68 p. 2. Boribekova F. B., Zhanatbekova N. Zh. Modern pedagogical technologies: Textbook. - Almaty: 2014. - 360 p.

	3. Zhumataeva E. Teaching literature in higher education using innovative technologies of education [Text]: textbook - Almaty: Epigraph, 2016. - 252 p. 4. Dzhurinsky A. Higher education in the modern world: trends and problems Edition: Prometheus 2017

Module title	Computational Methods for Corpuscular-Optical Systems (in English)
Semester	2
Responsible Instructor	Shugayeva Tilectes Zhalgasovna, PhD
Language of Instruction	Kazakh/Russian English
Correlation with the curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Student Workload (including contact hours and SWS)	Total workload: 120 h Contact hours: 40 h (20 h lectures, 20 h practical classes Independent study, including preparation for exams, in hours: 20 h SIWT, 60 h SIW
ECTS	4
Required and Recommended Prerequisites for Taking the Module:	Classical Mechanics. Electrodynamics. Mathematical Methods for Physics. Basic knowledge of computer modeling and programming
Module objectives/intended learning outcomes	**Learning objective:** To develop students' competence in the mathematical modeling, numerical simulation, and practical analysis of corpuscular-optical systems using modern computational tools and theoretical approaches. **The intended learning outcomes are:** Upon successful completion of the course, students will be able to: 1. Understand the principles of particle dynamics in electromagnetic and optical fields. 2. Apply analytical and numerical methods to model corpuscular-optical trajectories. 3. Design and optimize corpuscular-optical systems for scientific and industrial applications. 4. Use specialized software tools for simulation and analysis.
Content	This course introduces the theoretical foundations and computational methods for modeling and analyzing corpuscular-optical systems, which involve the motion and interaction of charged particles and light in complex electromagnetic and optical fields. Emphasis is placed on applications in mass spectrometry, electron optics, and scientific instrumentation.
Form of Examination	Traditional (prompts)
Requirements for Study and Examinations	- obtaining quality knowledge; - fulfil the teacher's requirements specified in the syllabus; - independently complete all types of work (SIWTassignments, coursework, graduation theses, etc.) and submit them to the teacher on time; - use reliable and trustworthy sources of information; - not to provide their work for cheating other students.
References	1. **Wollnik, H.** *Optics of Charged Particles*. Academic Press, 1987. – A comprehensive reference on the principles and calculations of particle optics, including electrostatic and magnetic lenses. 2. **Lieberman, M. A., & Lichtenberg, A. J.** *Principles of Plasma Discharges and Materials Processing*. Wiley, 2005. – Useful for understanding charged particle motion in plasma and field environments. 3. **Zavoisky, E. K., & Soloukhin, A. A.** *Charged Particle Optics Theory*. Nauka, 1980. – A classic work on corpuscular optics in Russian, often translated or cited in international research. 4. **Ghosh, P. K.** *Ion Beams: Fundamentals, Analysis and Applications*. Taylor & Francis, 2003. – Covers ion optics, beam transport, and applications relevant to mass spectrometry and microfabrication.

	5. **Reiser, M.** *Theory and Design of Charged Particle Beams*. Wiley-VCH, 2008. – Excellent for students dealing with complex beam systems and accelerator physics. 6. **Smith, R. A.** *A History of Mass Spectrometry*. Elsevier, 2004. – For contextual understanding of the development and applications of corpuscular-optical systems.

EP	7M05301- Physics
Module title	Fundamental Principles of Modern Physics (in Kazakh)
Semester	2 semester
Responsible Instructor	Sagimbayeva Shynar Zhanuzakovna Associate Professor
Language of Instruction	Kazakh languages
Correlation with the curriculum	Required component
Forms of Instruction	PBL
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 30 hours, IWMT – 25 hours, IWM – 80 hours (lecture, seminar etc.) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: general physics, mathematical physics, quantum field theory, general relativity, quantum mechanics, atomic nucleus and elementary particle theory.
Module objectives/intended learning outcomes	**Module objective:** To explain the basic principles of modern physics, the relationship between the symmetry of physical systems and the laws of relativity, which govern space-time coordinate transformations. **Learning outcomes:** 1. Uses the results for further independent cognitive activity in the field of new methods of higher professional education; 2. Evaluates the possibilities and main trends in the development of higher education. 3. Analyzes modern problems of science, contributes to the upbringing of creative aspirations in social development and the education system. 4. Solves any physics problems; knows the methods of their solution; independently composes the problem. 5. Systematizes and structures information about the development process of the content of higher education: fundamentalization, humanization, regionalization, differentiation, integration.
Content	The subject "Fundamental Principles of Modern Physics" is one of the basic professional subjects. Physical theory arises as a result of observation, practice and experimental research, and these lead to the creation of a physical model in the field of corresponding phenomena. The model is formulated and described in mathematical language and is a theory of this group of phenomena. In the axiomatic formulation of the theory, its entire content is reduced to basic conditions, and from these conditions, by means of logical and mathematical operations, all the consequences of the theory can be derived, this set of basic conditions is called the axioms or postulates of physical theory. The complete classical mechanics of Newton is based on three postulates - Newton's laws; classical electrodynamics - Maxwell's equations, etc. Along with these fundamental physical theories describing the specific phenomena of our world (mechanical and thermal motion), electromagnetic processes, and processes of the microworld, there are also general laws that affect all processes, all types of motion of matter. These laws are called by physicists the principles of modern physics, and they are an important structural part of the structural picture of the world. Knowledge of these principles, their application is important for a deeper understanding of the physics of phenomena and their complex interdependencies. For example, all physical processes obey the laws of conservation of physical quantities, and these laws follow from the properties of symmetry, which remain unchanged (invariant) under specific transformations.

	Symmetry plays a role in classical and quantum physics, but its role is especially important in quantum mechanics. Thus, the principle of indistinguishable particles leads to two types of particles, Bose-Einstein and Dirac statistics. Bosons and fermions have different commutative symmetries. The fundamental Pauli exclusion principle is fulfilled for fermions, and this principle is fulfilled in the periodic systems of atoms and nuclei.
Form of Examination	verbal ticket
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the total rating based on the results of the 1st and 2nd midterm tests are allowed to take the final exam
References	1. Bizhigitov, T. *Electrodynamics and the Special Theory of Relativity: Textbook*. – Almaty: Dauir RPBK LLP, 2012. – 448 p. 2. Davydov, A.S. *Quantum Mechanics*. – Moscow: Physico-Mathematical Literature, 1973. – 611 p. 3. Kirchanov, V.S., Tsaplin, A.I. *Concepts of Modern Natural Science: Textbook* / Edited by A.I. Tsaplin. – Perm: Perm State Technical University Publishing House, 2008. – 181 p. 4. Frauenfelder, H., Henley, E. *Subatomic Physics*. – Moscow: Mir, 1979. – 730 p. 5. Sakhiev, S.K., Zhusupov, M.A., Kabataeva, R.S. *Quantum Theory of Scattering: Textbook*. – Astana: L.N. Gumilyov Eurasian National University, 2012. – 210 p. 6. Tarasov, L.V. *Fundamentals of Quantum Mechanics*. – Moscow: Higher School Publishing House, 1978. – 287 p. 7. Elliott, J., Dawber, P. *Symmetry in Physics*. Vol. 1 – 368 p., Vol. 2 – 416 p. – Moscow: Mir, 1983.

EP	7M05301-Physics
Module title	Management of Science and New Technologies (in Russian)
Semester	2
Responsible Instructor	Zhubayev Abzal Kantarbayevich, Ass. Prof.
Language of Instruction	Russian
Correlation with the curriculum	Elective component
Forms of Instruction	CER, MOOC, etc.
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 30 hours, SIWT– 25 hours, SIW – 80 hours (lecture, lesson, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Psychology, Fundamentals of economic theory, Fundamentals of Law.
Module objectives/intended learning outcomes	The purpose of studying the discipline is to form undergraduates' understanding of management, as well as to develop management practice skills. Learning outcomes: 1) knows the modern theory and practice of management, classifies the factors affecting the organization; 2) applies the basic concepts of modern management, the basic ideas of modern management in real conditions; 3) has practical skills in analyzing managerial situations and making managerial decisions; 4) applies mathematical methods and elements of scientific research in applied tasks; develops and executes projects, uses resources efficiently; 5) assesses the applicability of the results obtained, identify ways to optimize the work of the organization.
Content	Methodological foundations of management. Management as a type of activity. The evolution of management. The organization as a subject and object of management. Integration processes in management. Communication in organizations and management. Managerial decisions in the management process. Management functions. Strategic and tactical

	planning in the management system. Organization and interaction of authorities. Motivation of activity in management. Regulation and control in the management system. Group dynamics and leadership. Human activity management and group management. Leadership: power and influence. Fundamentals of leadership and leadership style. Fundamentals of conflict theory. The culture of managerial activity. Innovations in a market economy. Methodological foundations of innovation management.
Form of Examination	Project
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the overall rating based on the results of the 1st and 2nd intermediate tests are allowed to take the final exam
References	Main references: 1. Boronina L.N. Fundamentals of project management: A textbook. / L.N. Boronina, Z.V. Senuk. – Yekaterinburg, UFU, 2015. 112 p. 2. Burke R. and Barron S. Project Management Leadership. Building creative Teams. 2nd edition. (John Wiley & Sons, Ltd, 2014). 372 p. 3. The Effective Manager's Handbook. Ed. Smith R., King D., Sidhu R. and Skelsey D. (APM Group Ltd, 2014). 598 p.

Module title	Modern Educational Technologies in Higher Education Institutions (in Kazakh)
Semester	2
Responsible Instructor	Aimaganbetova Z.K. PhD, associated professor
Language of Instruction	Kazakh
Correlation with the curriculum	Elective component
Forms of Instruction	CER, MOOC, etc.
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 30 hours, SIWT– 25 hours, SIW – 80 hours (lecture, lesson, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Methodology of Teaching Physics in Higher Education, Criterion-Based Assessment Technology, and Physics Teaching Methods"
Module objectives/intended learning outcomes	To create conditions for providing students, as future professionals, with the necessary knowledge and practical training to organize an educational process that fosters independent learning, self-regulation skills, the ability to engage in effective dialogue with diverse individuals, and the development of competencies in digital technologies—thus preparing them to become active citizens ready to succeed in the modern world.
Content	The education system is a complex structure comprising governing bodies, educational institutions of various types and levels, financial resources and material infrastructure that ensure the system's functioning and development, as well as scientific centers. The technological approach can be applied to any area of the education system—management, teaching, financing, monitoring, etc. Therefore, the concept of "educational technology" holds particular significance. The course on modern educational technologies in higher education institutions explores the objectives, methods, and approaches to mastering new pedagogical technologies in universities. It also examines the types of pedagogical technologies and the effectiveness of their application in the learning process. Continuous innovation has become a key factor for educational institutions. The effective use of modern technologies in higher education teaching processes will undoubtedly play a crucial role in preparing highly qualified specialists in the future.
Form of Examination	Oral
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the overall rating based on the results of the 1st and 2nd intermediate tests are allowed to take the final exam

References	Main References: 1. Zhanatbekova, N.Zh. Innovative Technologies in the Education System: Textbook / N.Zh. Zhanatbekova. – Almaty: CyberSmith, 2019. 2. Guidelines on Criterion-Based Assessment for Primary and Secondary School Teachers: Educational-Methodological Manual / AEO “Nazarbayev Intellectual Schools”, edited by O.I. Mozhaeva, A.S. Shilibekova, D.B. Ziedenova. – Astana, 2017. 3. Serkebayeva, S.K., Orynbayeva, G.S. Information Technologies in Physics: Textbook / S.K. Serkebayeva, G.S. Orynbayeva. – Almaty: TechnoErudit, 2018. Additional References: 4. Pedagogical Technologies: Textbook for Students of Pedagogical Specialties / General Ed. V.S. Kukushin. – Series "Pedagogical Education". – Moscow: IKC “Mart”; Rostov-on-Don: Publishing Center “Mart”, 2004. 5. Nurkasymova, S.N., Ashurov, A.U. Computer-Based Methods of Teaching Physics: Textbook / S.N. Nurkasymova, A.U. Ashurov. – Almaty: CyberSmith, 2017.

Module title	Luminescence of Crystalline Systems (in Kazakh)
Semester	3
Responsible Instructor	Aimaganbetova Z.K. PhD, associated professor
Language of Instruction	Kazakh
Correlation with the curriculum	Required component
Forms of Instruction	CER, MOOC, etc.
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 30 hours, SIWT– 25 hours, SIW – 80 hours (lecture, lesson, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Physics, solid state physics
Module objectives/intended learning outcomes	To develop an understanding of luminescence and its types, to describe various forms of luminescence, and to study their effects on solid-state materials
Content	Nowadays, the study of materials is one of the key issues in the development of modern technologies. The solid state is an aggregate state of matter characterized by overall stability and thermal motion in the form of small oscillations of atoms around their equilibrium positions. We live on the Earth’s surface, surrounded by solid materials—buildings and structures made from solid matter. It is impossible for the study of luminescence and related physical phenomena to lose relevance over time. This is due to the broad and constantly evolving practical applications of luminescence in science and technology.
Form of Examination	Oral
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the overall rating based on the results of the 1st and 2nd intermediate tests are allowed to take the final exam
References	Main References: 1. Aimaganbetova, Z.K. Deformation Luminescence and Radiation Defects in Alkali-Halide Materials. Monograph. – Almaty: "Medet Group" LLP, 2021. – 262 pages. 2. Shunkeev, K.Sh. Luminescence and Radiation Defects in Alkali-Halide Crystals under Lattice Symmetry Reduction. – Aktobe: AGPI Publishing House, 2012. – 516 pages. 3. Lushchik, Ch.B., Lushchik, A.Ch. Decay of Electronic Excitations with the Formation of Defects in Solids. – Moscow: Nauka, 1989. – 264 pages. Additional References:

	4. Pustovarov, V.A. Luminescence of Solids: Textbook / V.A. Pustovarov. – Yekaterinburg: Ural University Press, 2017. – 128 pages. 5. Goryunov, V.A., Grishaev, V.Ya., Nikishin, E.V. Luminescence: Laboratory Work Guidelines. – Saransk: Mordovia University Press, 2012. – 48 pages. 6. Vereshchagin, I.K., Kokin, S.M., Nikitenko, V.A. Luminescence of Solids and Its Application: Methodical Guidelines. – Moscow: Nauka, 1989. – 48 pages.

EP	7M05301- Physics
Module title	Processes Induced by Radiation in Solid Materials (in Kazakh)
Semester	3 semester
Responsible Instructor	Sagimbayeva Shynar Zhanuzakovna Associate Professor
Language of Instruction	Kazakh languages
Correlation with the curriculum	Required component
Forms of Instruction	PBL
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 30 hours, SIWT – 25 hours, SIW – 80 hours (lecture, seminar etc.) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: mechanics, molecular physics, electricity and magnetism, optics, condensed matter physics;
Module objectives/intended learning outcomes	**Module objective:** To introduce undergraduates to the basic laws and processes occurring in solids under various conditions. **Learning outcomes:** 1. Plans fundamental scientific and professional training in the field of physics, masters modern information technologies, including methods of research, processing and storage of scientific information. 2. Develops logical thinking, knowledge and understanding of the complex tasks facing future specialists. 3. Mastering the physical apparatus to the required extent with possible physical methods in technology. 4. Being able to simulate physical conditions using a computer, analyze new methods. 5. Use reference and educational literature during work, find and work with other necessary sources of information. 6. Mastering some practical methods for studying the characteristics of defects in solids.
Content	Study of the basic rules for defects in the crystal structure of solids of various sizes and nature, as well as the properties of defects, the mechanisms of their formation and interaction.
Form of Examination	Verbal, prompts
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the total rating based on the results of the 1st and 2nd midterm tests are allowed to take the final exam
References	**Main references:** 1. Lushchik Ch.B., Lushchik A.Ch. Decay of electronic excitations with the formation of defects in solid bodies.-M.: Nauka, 1989. p. 2. Shunkeev K.Sh. Luminescence and radiation defects in alkali halide crystals with reduced lattice symmetry. Monograph - Aktobe, 2012. - 516 p. 3. Aluker E.D., Gavrilov V.V., Deich R.G., Chernov S.A. Rapid radiation-stimulated processes in alkali-halide crystals. - Riga: Zinatne. 1987. -- 183 4. Sagimbaeva Sh.Zh. Technology of controlling the mechanism of energy transformation of ionizing radiation in alkali-halide crystals-scintillators. Monograph - Aktobe, 2017. - 120 p.

EP	7M05301-Physics
Module title	Mossbauer Spectroscopy in Solid State Physics (in Russian)

Semester	4
Responsible Instructor	Zhubayev Abzal Kantarbayevich, Ass. Prof.
Language of Instruction	Russian
Correlation with the curriculum	Elective component
Forms of Instruction	CER, MOOC, etc.
Student Workload (including contact hours and SWS)	Lectures – 15 hours, practical classes – 30 hours, SIWT– 25 hours, SIW – 80 hours (lecture, lesson, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites:
Module objectives/intended learning outcomes	The purpose of studying the discipline is to present the methods, laws, models and basic patterns of modern spectroscopy, and to develop the physical worldview of undergraduates. Learning outcomes: 1) knows and understands the nuclear transformations underlying the Mossbauer effect; the possibilities and limitations of using Mossbauer spectroscopy; the factors influencing the shape change of the resonant line of the Mossbauer spectrum; 2) applies the basic concepts of the Mossbauer effect and the methods of Mossbauer spectroscopy; mathematical models underlying the methods of processing Mossbauer spectra; optimization methods of the Mossbauer experiment; 3) classifies the analysis methods of the spectrum processing software package; 4) creates mathematical models of spectra based on processing methods; 5) evaluates the use of elements of mathematical methods and scientific research in applied problems and the possibilities of applying the results obtained.
Content	Nuclear gamma-resonance spectroscopy of metals and alloys. Investigation of the dynamic properties of the crystal lattice. Phase analysis of steels and iron alloys. Investigation of the ordering of displacement solid solutions. The distribution of embedding atoms in the lattice of the main phase components of steel. Structural and phase transformations under intense plastic deformations. Investigation of the surface layer of alloys. Interpretation of Mossbauer spectra of alloys. Electrical and magnetic hyperfine interactions of resonant nuclei in metals and alloys. The structure of the Mossbauer spectra of alloys with far and near atomic order. Mossbauer studies of atomic and magnetic structures of alloys. Mossbauer spectroscopy of ion-alloyed metals and alloys. Mossbauer studies of metal-metalloid implantation systems. Thermally induced processes in the austenitic steel-beryllium layered system. Experimental and theoretical description of thermally induced processes in the Fe-Be binary system.
Form of Examination	Project
Requirements for Study and Examinations	Students who have mastered the course material and scored at least 50% of the overall rating based on the results of the 1st and 2nd intermediate tests are allowed to take the final exam
References	Main references: 1. Zhubayev A. K. Fundamentals of nuclear gamma resonance spectroscopy. - Aktobe, 2013. 197 p. 2. Mössbauer Spectroscopy: Tutorial Book. Ed. Y. Yoshida, G. Langouche. (Springer-Verlag Berlin Heidelberg, 2013). 308 p. 3. The Rudolf Mössbauer Story. His Scientific Work and Its Impact on Science and History. Ed. M.Kalvius,P.Kienle. (Springer-Verlag Berlin Heidelberg, 2012). 433 p.

Module title	Methods and Equipment of Nanotechnology (in Kazakh)
Semester	3
Responsible Instructor	Amirbek Zarlykovich Bekeshev, candidate of physical and mathematical sciences, associated professor
Language of Instruction	Kazakh/Russian

Correlation with the curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Student Workload (including contact hours and SWS)	Total workload: 150 h Contact hours: 45 h (15 h lectures, 30 h practical classes) Independent study, including preparation for exams, in hours: 25 h SIWT, 80 h SIW
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	*General Physics* and *General Chemistry*
Module objectives/intended learning outcomes	**Learning objective:** The aim of studying the course "Methods and Equipment of Nanotechnology" is to explore the main classes of nanomaterials and nanotechnologies. **The intended learning outcomes are:** 1. Knows the main classes of nanomaterials and their properties. 2. Is able to distinguish nanotechnologies for producing modern nanomaterials, including key optical materials, as well as the main trends and directions of current developments. 3. Understands methods of obtaining nanomaterials and nanotechnologies using application and search systems, and research methods in the field. 4. Can practically apply methods for producing nanomaterials. 5. Is able to operate nanotechnology equipment.
Content	colloidal solutions, disintegration, mechanochemical synthesis, hydrothermal synthesis, synthesis of two-dimensional nanomaterials, substrate deposition, epitaxy, chemical precipitation from solutions, heterostructures, severe plastic deformation.
Form of Examination	Oral Exam (prompts)
Requirements for Study and Examinations	- obtaining quality knowledge; - fulfil the teacher's requirements specified in the syllabus; - independently complete all types of work (SIWTassignments, coursework, graduation theses, etc.) and submit them to the teacher on time; - use reliable and trustworthy sources of information; - not to provide their work for cheating other students.
References	1. Alferov, Z. I. *Double Heterostructures: Concept and Applications in Physics, Electronics, and Technology*. Physics–Uspekhi, 2020, Vol. 172, No. 9, pp. 1072–1086. 2. Beloshapko, A. G., Bukaemskii, A. A., & Staver, A. M. *Formation of Ultrafine Compounds under Shock-Wave Loading of Porous Aluminum: Study of the Obtained Particles*. Combustion, Explosion, and Shock Waves, 2019, Vol. 26, No. 4, pp. 93–98. 3. Boldyrev, V. V. *Mechanochemistry and Mechanical Activation of Solids*. Russian Chemical Reviews, 2017, Vol. 75, No. 3, pp. 203–216. 4. Generalov, M. B. *Cryochemical Nanotechnology: Textbook*. Moscow: Akademkniga, 2018. 325 p. 5. Gusev, A. I., & Rempel, A. A. *Nanocrystalline Materials: Textbook*. Moscow: Fizmatlit, 2021. 224 p.