MODULE HANDBOOK
EP BA 6B05301 – Physics

Aktobe, 2025

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Module Title	Module 1. Linguistic IYa 1101 Foreign language
Semester	1
Responsible Instructor	
Language of Instruction	English
Correlation with the Curriculum	GED
Forms of Instruction	Practical clases SIWT, SIW.
Student Workload (including contact hours and SWS)	Total workload: 150 hours Contact hours: 45 hours (45 hours of practical classes) Independent study, including exam preparation: 25 hours of SIWT, 80 hours of SIW
ECTS Credits	5
Required and Recommended Prerequisites for Taking the Module:	To successfully complete the course "English Language", students need knowledge of the following aspects of the language: phonetics - basic rules of reading and pronunciation of letters alphabet and combinations in speech flow; spelling - writing letters and combinations corresponding to certain sounds; vocabulary - most frequently used words, word-forming models; grammar - basic grammatical
Module Objectives / Expected Learning Outcomes	The goal is to form intercultural and communicative competence of students in the process of foreign language education at a minimum sufficient level. 1. Memorize and reproduce key words, phrases, and expressions on familiar topics; identify basic grammar rules and structures at the elementary level; acquire a basic vocabulary and common phrasal verbs. 2. Understand simple and familiar texts at a basic level; extract main ideas and information from simple texts on familiar topics; comprehend basic directions and instructions in English. 3. Use basic words, phrases, and grammatical structures to communicate on familiar topics; construct simple sentences and short texts in English; apply acquired language skills in everyday situations such as greetings, introductions, asking questions, and expressing simple wishes. 4. Identify main ideas and details in simple English texts; recognize basic grammar structures and vocabulary in sentences; analyse and correct mistakes and inconsistencies in their own speech. 5. Assess their level of English proficiency and identify strengths and weaknesses; evaluate the logic of text structure; maintain conversations on studied material; give recommendations in everyday situations; use language tools in speech and independently correct mistakes.
Course Content	In the course of foreign language teaching, various types and forms of work are used to prepare students for the subsequent use of the English language for professional purposes, as well as as a means of cognitive and communicative activities.
Form of Examination	Oral exam
Requirements for Study and Examinations	Regular attendance and active participation in class activities. Completion of homework assignments (vocabulary, grammar, writing tasks, listening, and reading). Participation in dialogues, role-plays, and oral mini-presentations on everyday topics. Demonstration of progress in all four-language skills: listening, speaking, reading, and writing.

References	1. Davies P.A., Falla T. - SOLUTIONS Elementary Student's Book. Third Edition / Oxford University Press, 2018 - 164 pages. https://rmebrk.kz/search/?search=SOLUTIONS+Pre+-Intermediate 2. Romanovskaya, N. V. Professional English Language: Study Guide / Chernyaeva E.V., Zelenkova S.K. - Moscow: MSTU GA, 2014 3. Oxford Qazaq Dictionary: for studying the discipline / Kazakh-English and English-Kazakh Dictionary. Project Leader: R. Kenzhekhanuly. - Almaty: National Translation Bureau, 2023 - 65 copies. 4. Chazal, E. Oxford EAP. A Course in English for Academic Purposes. Intermediate/B1+: Teacher's Handbook / E. Chazal, L. Rogers. - China: Oxford University Press, 2013 - 30 copies. 5. Professionally-Oriented Foreign Language (English): Study Guide. / Compiled by A.Kh. Amerkhanova, M.K. Karimbergenova, B.M. Yesengeldin; Toraighyrov University, Pavlodar. - Pavlodar: Toraighyrov University, 2019 - 68 pages. - ISBN 978-601-238-936-4. https://rmebrk.kz/ 6. Batinova, A. S. Practical Course of the English Language: For All Specialties and Fields of Study / A.S. Batinova, G.N. Turzhanova. - Aktobe: K. Zhubanov Aktobe Regional University, 2008 7. Nakesheva S.T. Methodological Guidelines for Practical Classes on the Discipline "English Language" for First and Second Year Full-Time Students. Edition: Aktobe, 2014 http://neb.arsu.kz/view?rid=5239&fid=5222 8. Baizhanova, A. A. Collection of Tests and Assignments in the English Language: for studying the discipline / A. A. Baizhanova, A. S. Musralina. - Aktobe K. Zhubanov Aktobe Regional University, 2015 9. Berstenova A.B. English Grammar Handbook with Practice Exercises. Edition: Aktobe, 2014 http://neb.arsu.kz/view?rid=5236&fid=5220 10. Berstenova A.B. Grammar Reference of the English Language with Exercise Collection. Edition: Aktobe, 2015 http://neb.arsu.kz/view?rid=5237&fid=5221 11. Shevyakova, V. E. Modern English Language: Word Order, Actual Division, Intonation / V.E. Shevyakova. - Moscow: Nauka, 1980. 12. Sabitova, Leyla Seitzhaparovna Pair-Aspect System of Russian Verbs and Methods of Its Transformation into Kazakh and English: Abstract of the Dissertation for the Degree of Doctor of Philosophy (PhD) (10.00.00). / L.N. Gumilyov Eurasian National University. - Astana, 2010 - 28 p. 13. Masalimova A.S. English Grammar Handbook with Practice Exercises under the editorship of A.S. Masalimova / Publishing Center : K. Zhubanov Aktobe Regional University, 2014 - 77 pages. http://neb.arsu.kz/view?rid=5236&fid=5220

Module title	Module 1. Linguistic IYa 1101 Foreign language
Semester	2
Responsible Instructor	
Language of Instruction	English
Correlation with the Curriculum	GED
Forms of Instruction	Practical classes, SIWT/SIW
Teaching load (including contact hours, SIW)	Total workload:150 hours Contact hours: 45 hours (practice classes), independent study, including exam preparation, in hours: 25 hours SIWT, 80 hours SIW

ECTS	5
Required and Recommended Prerequisites for Taking the Module:	This module requires the knowledge, skills and abilities acquired during the study of English at the level A1 ‘minimal-sufficient’ (pre-threshold level of foreign language proficiency according to the Common European Framework of Reference for Languages).
Module objectives/expected learning outcomes	Learning objective: The aim is to form students' intercultural-communicative competence in the process of foreign language education at a sufficient level (A2 Common European Competence) Learning Outcomes: 1. identify the topic of a text, dialogue and recognise grammatical structures; ask and be able to answer simple questions about the material covered; 2. reproduce the essence of the read/listened text, divide or reconstruct in the correct logical order the parts of the text (dialogue), support a conversation and discussion on a familiar topic in a concrete situation, simulate a situation of everyday life; 3. analyse grammatical structures and compare their application in a given context, break a text into logical parts and identify its main idea, transform and paraphrase sentences, interpret the content of a text in simple words; 4. compose a dialogue (simulation), summarize the studied material, describe a situation from everyday life; 5. evaluate the logic of text construction, form an opinion on the text (dialogue), maintain a conversation on the studied material, give recommendations in everyday life.
Contents	English language teaching in higher education is an independent and complete course. It is designed to provide students with training in the discipline ‘Foreign Language’ as one of the compulsory disciplines of the general education cycle. This discipline includes the study of topics of socio-domestic and socio-cultural spheres of communication and is aimed at the formation of intercultural-communicative competence at the level of basic standardization. You will learn and understand the most common English words and phrases: the most basic information about a person and his/her family, shopping, work, location. This is the level at which the learner will be able to speak intelligibly on the simplest topics. Vocabulary: about 1500-2500 words. Foreign Language at A2 level aims to develop the basic language skills and abilities needed to communicate in simple and everyday situations. Students learn to understand and use frequently occurring expressions and phrases, as well as to read and write simple texts.
Form of examination	oral
Requirements for Study and Examinations	Mandatory attendance at practical classes, active participation in the discussion of issues, preliminary preparation for practical classes, qualitative and timely fulfilment of assignments, participation in all types of control. The final assessment takes place in the format of an oral examination (on tickets). The examination is conducted in accordance with the academic integrity policy of the university and the rules of examinations. Examination questions are compiled according to Bloom's taxonomy.
Required references	Educational references: 1. Davies P.A., Falla T. - SOLUTIONS Elementary Student’s Book. Third Edition / Oxford University Press, 2018 - 164 p. https://rmebrk.kz/search/?search=SOLUTIONS+Pre+-Intermediate 2. Romanovskaya, N. V. Professional English Language: Study Guide /

	Chernyaeva E.V., Zelenkova S.K. - Moscow: MSTU GA, 2014 3. Oxford Qazaq Dictionary: for studying the discipline / Kazakh-English and English-Kazakh Dictionary. Project Leader: R. Kenzhekhanuly. - Almaty: National Translation Bureau, 2023 - 65 copies. 4. Chazal, E. Oxford EAP. A Course in English for Academic Purposes. Intermediate/B1+: Teacher's Handbook / E. Chazal, L. Rogers. - China: Oxford University Press, 2013 - 30 copies. 5. Professionally-Oriented Foreign Language (English): Study Guide. / Compiled by A.Kh. Amerkhanova, M.K. Karimbergenova, B.M. Yesengeldin; Toraighyrov University, Pavlodar. - Pavlodar: Toraighyrov University, 2019 - 68 pages. - ISBN 978-601-238-936-4. https://rmebrk.kz/ Educational and methodical references: 1. Batinova, A. S. Practical Course of the English Language: For All Specialties and Fields of Study / A.S. Batinova, G.N. Turzhanova. - Aktobe: : K. Zhubanov Aktobe Regional University, 2008 2. Nakesheva S.T. Methodological Guidelines for Practical Classes on the Discipline "English Language" for First and Second Year Full-Time Students. Edition: Aktobe, 2014 http://neb.arsu.kz/view?rid=5239&fid=5222) 3. Baizhanova, A. A. Collection of Tests and Assignments in the English Language: for studying the discipline / A. A. Baizhanova, A. S. Musralina. - Aktobe: : K. Zhubanov Aktobe Regional University, 2015 4. Berstenova A.B. English Grammar Handbook with Practice Exercises. Edition: Aktobe, 2014 http://neb.arsu.kz/view?rid=5236&fid=5220) 5. Berstenova A.B. Grammar Reference of the English Language with Exercise Collection. Edition: Aktobe, 2015 http://neb.arsu.kz/view?rid=5237&fid=5221) Scientific references: 1. Shevyakova, V. E. Modern English Language: Word Order, Actual Division, Intonation / V.E. Shevyakova. - Moscow: Nauka, 1980. 2. Sabitova, Leyla Seitzhaparovna Pair-Aspect System of Russian Verbs and Methods of Its Transformation into Kazakh and English: Abstract of the Dissertation for the Degree of Doctor of Philosophy (PhD) (10.00.00). / L.N. Gumilyov Eurasian National University. - Astana, 2010 - 28 pages. 3. Masalimova A.S. English Grammar Handbook with Practice Exercises edited by A.S. Masalimova / Publishing Center : K. Zhubanov Aktobe Regional University, 2014 - 77 pages. http://neb.arsu.kz/view?rid=5236&fid=5220 Electronic resources: 1. Free Printable Worksheets: [Busy Teacher Classroom Activities] https://busyteacher.org/classroom_activities 2. Vocabulary Activities: [Teaching English](https://www.teachingenglish.org.uk) 3. English Grammar: [Learning Apps - Grammar Category] https://learningapps.org/index.php?category=3&subcategory 4. Dialogue Trainer for English of Various Difficulty Levels: [At the Pub - Catch English] https://catchenglish.ru/dialogi/dialogi-srednej-slozhnosti/at-the-pub.html

Module Title:	Kazakh (Russian) Language
Semester	2
Responsible Instructor:	Tuleusheva Salima Diasovna
Language of Instruction:	Kazakh / Russian
Correlation with the Curriculum	University component
Forms of Instruction:	Practical classes, SIWT, SIW
Workload (including contact hours and independent work):	Total workload: 150 hours Contact hours: 45 hours of practical classes Independent study, including exam preparation: 25 hours SIWT, 80 hours SIW ECTS Credits: 5
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Participation in all forms of instruction requires prior preparation and active involvement. To successfully complete this module, students should possess the knowledge, skills, and competencies acquired through the following courses: Russian Language, Practical Russian Language.
Module Objectives / Intended Learning Outcomes:	Learning Objective: To develop students' knowledge and practical skills in the field of modern Russian language in accordance with established philological traditions and the contemporary scientific paradigm. Learning Outcomes (LO11): 1. Has a command of the main language studied in its literary form, and possesses basic methods and techniques of various types of oral and written communication in the field of Russian language. 2. Is able to formulate arguments and solve professional tasks in the process of learning the Russian language. 3. Describes the language situation in Kazakhstan, identifying issues of national linguistic and cultural identity, and the ethnic and cultural conditioning of worldviews. 4. Explains the studied rules of orthography, orthoepy, and punctuation. 5. Can communicate in Russian, taking into account orthographic and punctuation norms.
Content	The course is aimed at developing the learner's linguistic identity, enabling them to carry out cognitive and communicative activities in Russian and in various spheres of communication within the framework of state programs on trilingualism and the spiritual modernization of national consciousness. It is designed to foster competencies based on national awareness and the cultural code of qualities such as internationalism, tolerance toward world cultures and languages, and proficiency in advanced modern technologies—factors that contribute to the country's modernization and the personal career growth of future professionals. The following Forms of Instruction will be used during the course: seminar, blended learning methods such as flipped classroom, face-to-face, station rotation, individual rotation model; exercises, brainstorming, academic debates, and case method.
Form of Examination	The exam format is an oral response based on exam tickets.
Requirements for Study and Examinations	All students are required to attend classes and arrive on time. All assignments for practical classes, SIW/SIWT, and midterm or ongoing assessments must be submitted on time. Late submissions will not be accepted. The use of mobile phones during classes and while taking ongoing, midterm, and final assessments is prohibited (except when used as instructed by the teacher).

EP	6B05301 – Physics
Module Title:	History of Kazakhstan
Semester	1,2
Responsible Instructor:	Abdullayev Nurtaza
Language of Instruction:	Russian, Kazakh
Correlation with the Curriculum	General Education Discipline, Core Component
Forms of Instruction:	Lectures, Practical Sessions, SIWT, SIW.
Workload (including contact hours and independent work):	Total Workload: 150 hours Contact Hours: 45 hours (30 hours of lectures, 15 hours of practical sessions) Self-Study, including exam preparation, in hours: 25 SIWT, 80 hours of SIW
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	To master this module, it is necessary to have the knowledge, skills, and competencies acquired through the study of the following school subjects: "History of Kazakhstan," "World History," and "Man. Society. Law."
Module Objectives / Intended Learning Outcomes:	The purpose of studying this discipline is to provide objective knowledge about the main stages of the development of the history of Kazakhstan from ancient times to the present. Learning outcomes: (LO-1) Demonstrates knowledge and understanding of world history and the history of Kazakhstan, masters a system of theoretical knowledge on fundamental issues of historical scientific disciplines, and reflects the place and role of Kazakhstan in world history and cultural processes. 1. Demonstrate knowledge of the history of Kazakhstan from ancient times to the present, understanding the unity of the general, the particular, and the unique, combining specific facts with a comprehensive picture of global development. 2. Analyze phenomena of Kazakhstan's past and present from the standpoint of historicism and a dialectical understanding of the multidimensional and contradictory nature of historical processes. 3. Possess the ability to critically and comprehensively analyze information from various historical and contemporary sources, and independently and creatively comprehend issues of social development in both the past and present. 4. Demonstrate a respectful attitude toward national and world history and culture, and strive to preserve and enrich the heritage of humanity’s material and spiritual culture. 5. Assess the significance of the unique path of development of modern Kazakhstan, critically comprehend historical processes, and be able to propose solutions to current social issues.
Content	The curriculum for the discipline "History of Kazakhstan" consists of five thematic blocks: 1. Ancient people and the formation of the nomadic civilization 2. The Turkic civilization and the Great Steppe 3. Kazakhstan in the new era (18th – early 20th centuries) 4. Kazakhstan during the Soviet period 5. Independent Kazakhstan The discipline “History of Kazakhstan” is a mandatory course for all educational programs. The instructional methods and technologies employed in this discipline encompass interactive and digital tools, project-based

	learning methodologies, problem-based learning techniques, and specific strategies such as "Jigsaw," "INSERT," "problem lecture," "working with historical documents," and "fishbone," among others.
Form of Examination	Computer test
Requirements for Study and Examinations	Mandatory attendance of classroom sessions, active participation in discussions, prior preparation for lectures and practical classes, timely and high-quality completion of independent study assignments (ISA), and participation in all forms of assessment are required. Students are allowed to take the state examination only if they have mastered the course material and have scored at least 50% of the total rating based on the results of the 1st and 2nd interim assessments.
References	1. Abusseitova M.Kh. Kazakhstan and Central Asia in the XV-XVII centuries: History, Politics, Diplomacy. – Almaty: Daik-Press, 1998. – 592 p. 2. Abylkhozhin Zh.B. The Post-Stalin Period in the History of Soviet Kazakhstan: A Series of Doomed Reforms and Unfulfilled Declarations (1953 - 1991). – Almaty: KBTU, 2019. – 465 p. 3. Abylkhozhin Zh.B. The Country in the Heart of Eurasia: Essays on the History of Kazakhstan. – Almaty: Kazakh University, 1998. – 280 p. 4. Abdurakhmanov N.A. Modern History of Kazakhstan: A Textbook. – Karaganda: Aknur Publishing, 2017. – 346 p. (AknurPress) 5. Abdullaev N.A. The History of Independent Kazakhstan (1900-2018): A Textbook. – Astana: Turan University, 2019. – 315 p. 6. Abdullaev N.A. Modern History of Kazakhstan (1900-2017): A Textbook. – Aktobe, 2017. – 428 p. 7. Berdenova R.K. History of Kazakhstan: A Textbook. – Almaty: Medet Group, 2019. – 296 p. (AknurPress) 8. History of Kazakhstan. Documents and Materials (1917-2012) \[Text]: Reader. – Almaty: Shanyrak Media, 2017. – 320 p. 9. Nazarbayev N.A. The Era of Independence. – Astana, 2017. – 508 p. 10. Khafizova K.Sh. Steppe Rulers and Their Diplomacy in the XVIII-XIX Centuries. – Nur-Sultan: KISI under the President of Kazakhstan, 2019. – 480 p. 11. Grivennaya L.A. The New History of Kazakhstan (Test Collection): Educational and Methodological Guide for the specialty "History" (050114). – Petropavlovsk: North Kazakhstan State University, 2012. – 100 p. (http://rmebrk.kz/) 12. Pishulina K.A. Essays on the History of the Kazakh Khanate: Collection of Articles. – Almaty: Institute of History and Ethnology, 2016. – 350 p. ISBN 978-601-7342-14-2 (https://djvu.online/file/Q5IG53yDUwRAo) 13. History of Independent Kazakhstan \[Text]: \[Monograph] / \[Abzhanov Kh.M. et al.]; Ministry of Education and Science of Kazakhstan, Institute of History and Ethnology. – Almaty: Kazakh Encyclopedia, 2011. – 399 p. : portraits, tables: 25 cm.; ISBN (https://rusneb.ru/catalog/000199_000009_005379944/) 14. Yerofeeva I.V. Symbols of Kazakh Statehood (Late Medieval and Modern Periods). – Almaty: Daik-Press, 2001. – 256 p.

	15. Yerofeeva I.V. Khan Abulkhair: Military Leader, Ruler, Politician. – Almaty: Daik-Press, 2007. – 456 p. 16. Ismagulov O., Ismagulova A. The Origin of the Kazakh People: Based on Physical Anthropology Data. – Almaty, 2017. – 196 p. 17. Kumekov B.E. The State of the Kimaks in the IX-XI Centuries. – Almaty: Nauka, 1972. – 695 p. 18. Klyashtorny S.G., Sultanov T.I. States and Peoples of the Eurasian Steppes: Antiquity and the Middle Ages. – St. Petersburg: Petersburg Oriental Studies, 2004. – 368 p. 19. Koigeldiev M.K. Stalinism and Repressions in Kazakhstan (1920-1940). – Almaty, 2009. – 448 p. 20. Masanov N.E. The Nomadic Civilization of the Kazakhs: Foundations of the Nomadic Society's Vital Activity. – Almaty: Horizon, 1995. – 320 p. 21. Sultanov T.I. Raised on the White Felt: Khans of the Kazakh Steppes. – Astana: Astana Damu, 2006. – 256 p.

EP	6B05301 – Physics EP–BA 6B05301 – Physics
Module title	Information and Communication Technologies (in English)
Semester	1
Responsible Instructor	Shangytbayeva Gulmira Asaugalikyzy
Language of Instruction	English languages
Correlation with the Curriculum	Compulsory component
Forms of Instruction	Lecture-based teaching, Problem-solving sessions, Case studies, Collaborative learning, Blended learning, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 15 hours, labworks – 15 hours, SIWT – 25 hours, SIW – 80 hours / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	To master this module, it is necessary to have the knowledge, skills, and competencies acquired through the study of natural science subjects in secondary school.
Module objectives/intended learning outcomes	Module objective: The main objective of the course is to teach students how to solve physical problems using computer models and algorithms. In this course, students will learn to model physical phenomena, apply computational methods, develop programming skills, and enhance their ability to analyze solutions. In addition, students will gain an understanding of the role of modern computer technologies in solving physical problems and will learn to make creative decisions. Learning outcomes: Understand and apply methods of computer modeling of physical phenomena; Develop the ability to use computer programs and algorithms for solving physical problems; Write programs for physical problems using programming languages; Analyze computational results and present them using graphs and diagrams; Master mathematical modeling of physical processes and methods for computing them using a computer; Analyze solutions and apply them effectively.
Content	The course "Solving Physical Problems Using Computers" focuses on the application of computational methods and computer modeling in solving physical problems. It enables students to translate physical phenomena into mathematical models and find effective solutions through computer programs. The course is aimed at exploring physical laws through algorithms, programming, and numerical methods. Students will use computer tools to solve physical problems and master both analytical and numerical techniques.
Forms of Instruction	Oral exam
Requirements for Study and Examinations	Students who have successfully mastered the course material and achieved at least 50% of the total score from the 1st and 2nd midterm assessments are eligible to take the final exam.
References	Main References / Materials V.I. Klein, V.V. Petrov – Fundamentals of Radio Engineering P.B. Zbar, A. Davis, L. Murray – Fundamentals of Radio Electronics V.V. Kuleshov – Radio Engineering Systems V.M. Karpov – Fundamentals of Radio Engineering and Radio Systems V.V. Popov, K.N. Samoylov – Radio Electronics: Circuitry and Devices Additional References: N.V. Voitovich – Fundamentals of the Theory of Radio Engineering Circuits G. Schill, G. Zelle – Radio Electronics for Beginners

	A.A. Reyzin – Radio Engineering Systems: Antennas and Radio Wave Propagation L.M. Matveev – Electromagnetic Fields and Waves in Radio Engineering

Module Title:	IFN ASBM-1107 Module of Socio-Political Knowledge
Semester	1
Responsible Instructor:	Sarsembin U.K.
Language of Instruction:	Kazakh
Correlation with the Curriculum	University component (UC) in the cycle of basic disciplines (BD)
Forms of Instruction:	Lectures, practical classes, SIWT, SIW
Workload (including contact hours and independent work):	Total workload: 120 hours Contact hours: 40 hours (15 hours of lectures, 25 hours of practical classes) Independent study hours, including exam preparation: 20 hours of SIWT, 60 hours of SIW
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	To study the Socio-Political Disciplines module, students must have prior knowledge of history, society and culture, law, and a general background in the social and humanitarian sciences.
Module Objectives / Intended Learning Outcomes:	To contribute to the development of students as future professionals and citizens of the state. This involves explaining the nature of society, the patterns of its development, its internal structure, and the functioning of social institutions. The aim is to form a professional qualification characterized by a high level of political culture, capable of deeply analyzing current policies both globally and nationally and contributing to their development.
Content	The concept of society, the social structure of society, and the patterns of societal development. The role of sociology and political science in studying the specific features of the socio-economic and political development of modern society. Key categories of sociology and political science, sociological research, types and functions of social institutions, the role of the family institution in society, the state, political consciousness, political culture, political ideology, the role of the political elite in the spiritual and political life of the state, the activities of political parties, and more.
Form of Examination	Computer test
Requirements for Study and Examinations	Complete mastery of the course topics, studying the references throughout the course, understanding the specifics and relevance of each topic, and having a deep knowledge of the social structure of society and the activities of political institutions, as well as the methods and techniques of social and humanitarian sciences.

References	**Main References:** 1. Brinkerhoff D. Fundamentals of Sociology: Textbook / D. Brinkerhoff, D. Weitz, S. Ortega. – Almaty: National Translation Bureau, 2018. – pp. 215-221. 2. Ritzer D. Sociological Theory: Textbook / D. Ritzer, D. Stepnitsky. – Almaty: National Translation Bureau, 2018. – 856 p. 3. Gabdullina K. Sociology: Textbook. – Almaty: Nur-Press, 2019. – 210 p. ISBN 978-9965-830-86-0. 4. Sociological and Analytical Studies on Language Policy Issues in the Republic of Kazakhstan: Social Research / Edited by the Committee on Language Development of the Ministry of Culture and Sports of the Republic of Kazakhstan. – Astana: TOO Sana, 2018. – 145 p. 5. Nazarbayev N. Looking into the Future: Modernization of Public Consciousness (Bolashakka Bagdar: Ruhani Zhangyru). – Astana: REGIS-ST Polygraph, 2017. – 55 p. 6. Sarsenbekov N.Zh. Political Science (in Table Form): Study Guide. – Almaty: SSC, 2017. – 84 p. 7. Sydykov U. Political Science. – Almaty, 2012. – pp. 53-62. 8. Rakhymbayeva A. Political Science (Lecture Collection). – Astana, 2012. – pp. 67-81, 137-141. 9. Absattarov R. Fundamentals of Political Science. Volume 1: Study Guide. – Almaty: Karasai, 2018. – 472 p. 10. Absattarov R. Fundamentals of Political Science. Volume 2: Study Guide. – Almaty: Karasai, 2018. – 460 p.

EP	6B05301 – Physics
Module Title:	Physical culture
Semester	1-2-3-4
Responsible Instructor:	Mukhtarov Seytkerei Malikovich, Erjanov Gabit Kuanalievich
Language of Instruction:	Kazakh / Russian
Correlation with the Curriculum	OOD (Obligatory Educational Discipline)
Forms of Instruction:	Practical classes
Workload (including contact hours and independent work):	Total workload: 240 hours Contact hours: 45 hours (60 hours of practical classes)
ECTS	
Required and Recommended Prerequisites for Taking the Module:	To memorize and master vital skills and abilities (walking, running, skiing, swimming, etc.); to possess the means of physical culture for developing specific physical qualities. To remember the skill of conducting independent physical exercise sessions. Understanding the fundamentals of physical culture and sports, physical education, self-discipline, and self-education, physical development, physical and functional fitness, psychophysical readiness, and the professional orientation of physical education. Application of knowledge about the functioning of the human body and its individual systems under the influence of physical exercises and sports in various environmental conditions. Analysis of the scientific and biological foundations of physical culture and the basics of a healthy lifestyle. Synthesis of practical skills and abilities that ensure the preservation and strengthening of health, mental well-being, the development and improvement of psychophysical abilities, qualities, and characteristics of personality, and self-identification in physical culture.

	Evaluation: The ability to properly assess one's physical condition. Mastering the skills of self-assessment of performance, fatigue, exhaustion, and the application of physical culture means for correction.
Module Objectives / Intended Learning Outcomes:	The goal of the academic discipline *"Physical Culture"* at the university level is to develop students' social and personal competencies that ensure the purposeful use of appropriate means of physical culture and sports for maintaining and strengthening health, as well as preparing for professional activities.
Content	The discipline "Physical Culture" is included in the curriculum for students of all forms of study and training programs across all specializations. It is a mandatory component of the humanitarian education block and is aimed at developing the student's personal physical culture, preparing them for social and professional activities, and maintaining and strengthening health. This discipline also contributes to the expansion and in-depth study of knowledge and skills in physiology, pedagogy, and psychology, thereby enhancing the professional competence of future specialists. Forms of Instruction used: circuit training method, repetition method, frontal method, competitive method.
Form of Examination	practical
Requirements for Study and Examinations	Mandatory attendance of classes, active participation in physical education lessons, prior preparation for practical sessions, timely and high-quality completion of homework assignments, and participation in all forms of assessment.
References	Main References: 1. Aizakov A.D. Monitoring of Physical Health and a Healthy Lifestyle of Children, Adolescents, and Youth at the Regional Level: Study Guide. - \[B.M.], 2012. - 120 p. 2. Yevseyev Y.I. Physical Culture: Study Guide. - 6th ed. - \[B.M.]: Phoenix, 2010. - 444 p.: ill. - (Higher Education). 3. Barchukova G.V. Table Tennis at the University: Study Guide for Students of Non-Physical Education Universities / G.V. Barchukova, A.N. Mizin. - Moscow: SportAkademPress, 2002. - 132 p. 4. Melnikov V.S. Physical Culture at the University: Study Guide. - Orenburg: OSU, 2002. - 114 p. (https://rmebrk.kz/) 5. Grishina Y.I. Physical Culture of Students: Study Guide. - Rostov-on-Don: Phoenix, 2019. - 283 p. - (Higher Education). - ISBN 978-5-222-31286-5. (https://rmebrk.kz/) 6. Yevseyev Y.I. Physical Education: Study Guide. - 6th edition. - \[B.M.]: Phoenix, 2010. - 444 p. 7. Barchukova G.V. Table Tennis at Higher Educational Institutions: Study Guide for Non-Physical Education University Students / G.V. Barchukova, A.N. Mizin. - Moscow: SportAkademPress, 2002. - 132 p. 8. Kulanova K.K. Theory and Methods of National Sports in Schools: Study Guide / K.K. Kulanova, U.S. Marchibayeva, A.K. Akhmetov. - Almaty: New Book, 2021. 9. Uanbayev E.K. Methods of Teaching Physical Education and Sports: Study Guide. 4th revised and expanded edition. - Ust-Kamenogorsk: S. Amanzholov East Kazakhstan State University, "Berel" Publishing House, 2014. - 360 p. (https://rmebrk.kz/) 10. Uanbayev E.K., Uanbayeva F.Zh. Theoretical Methods of Physical Culture and Sports: Study Guide. - Ust-Kamenogorsk: EKSU Publishing House, 2006. - 267 p. - ISBN 9965-687-86-2.

EP	6B05301 – Physics
Module title	MA 1201, Mathematical analysis
Semester	1
Responsible Instructor	Otarov Kh.T.
Language of Instruction	Kazakh, Russian
Correlation with the Curriculum	Required component
Forms of Instruction	PBL, teamwork, flipped classroom, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 20 hours, practical classes – 30 hours, SIWT – 20 hours, SIW – 60 hours / 120 hours
ECTS	4
Required and Recommended Prerequisites for Taking the Module:	To master this module, it is necessary to have the knowledge, skills, and competencies acquired through the study of the following courses: Elementary Mathematics and Mathematical Analysis.
Module objectives/intended learning outcomes	The goal of the course is the professional and methodological training of future mathematics teachers to teach elements of probability theory and mathematical statistics in schools. Learning Outcomes – A, B, C: A) Knows the place of mathematical analysis within the system of mathematical knowledge; Possesses the facts and methods of mathematical analysis; Demonstrates a culture of thinking, the ability to generalize, analyze, perceive information, set goals, and choose paths to achieve them; Masters the fundamental facts, ideas, and methods of mathematics, including the axiomatic method; Is able to apply knowledge and methods from other disciplines in mathematical analysis; Can use knowledge of mathematical analysis in other scientific fields; Is familiar with the main stages in the development of mathematics. B) Is capable of preparing and editing texts of professional and socially significant content; Has command of mathematical language; Is capable of proving theorems; Is able to create mathematical models to solve problems from various fields. C) Is capable of constructing logically coherent oral and written speech; Can create and analyze mathematical objects using analytical methods; Possesses skills in public speaking, conducting discussions, and engaging in debates. D) Is prepared to interact with colleagues and work in a team. E) Knows how to effectively apply teaching knowledge and skills; Understands the social significance of their future profession; Is motivated to perform professional activities; Is capable of taking responsibility for the results of their professional work.
Content	Elements of set theory and mathematical logic. Number sets. Functions and sequences. Limit theory, continuity of functions. Differential and integral calculus of functions of one variable, their properties and graphs (using Desmos, QuickGraph+). Differential and integral calculus of functions of several variables. Series theory and elements of field theory.
Forms of Instruction	Oral exam
Requirements for Study and Examinations	Mandatory attendance of both online and in-person classes, active participation in discussions, prior preparation for lectures and practical sessions, timely and high-quality completion of SIW assignments, and participation in all forms of assessment.
References	**Main references:**

	1. Otarov Kh.T. Mathematical Analysis. – Almaty: Economy, 2012. – 536 p. 2. N. Temirgaliev. Mathematical Analysis. – Part 1. Almaty: Mektep, 1987. 3. Kh.I. Ibrashev, Sh.T. Erkegulov. Course of Mathematical Analysis. – Vol.1. Almaty: Kazmemoqpedbas, 1963. 4. Fikhtengolts G.M. Course of Differential and Integral Calculus. Vol.1: Textbook. – 4th ed. – Moscow: Nauka, Main Editor of Physical-Mathematical Literature, 2012. – 656 p. 5. Tokybetov Zh.E. Mathematical Analysis, 2009 6. Karasheva G. Mathematical Analysis: 2017, RIEL 7. Ibraimkulov Ä.M., Smatova G.D. Mathematical Analysis-I: 2010, RIEL 8. Aktaeva U.Zh. Mathematical Analysis 2011, RIEL 9. Makhimova S.Zh. Mathematical Analysis 2011, RIEL 10. Zhanabayev Zh. Mathematical Analysis. 2008, RIEL Additional references: 11\. Pilidi V.S. Mathematical Analysis: Textbook – Rostov-on-Don: Phoenix, 2009. – 239 p. 12\. Askarova M.A. Elementary Mathematics. Algebra: Textbook. Karasay, 2013. 13\. Musin A.T. Mathematics I (Lectures. Test collection): Textbook / A.T. Musin. – Almaty: LLP RPBC Dauir, 2012. – 312 p. 14\. Nadyrbekova A.Sh. Mathematical Analysis. – Taraz, TarMPI, 2012. – 260 p. 15\. Akhmetova S.S. Mathematical Analysis: 2008, RIEL 16\. V.A. Ilyin, V.A. Sadovnichiy, Bl. Kh. Sendov. Mathematical Analysis. – Part 1. Moscow: MSU Publishing, 2004. 17\. V.A. Zorich. Mathematical Analysis. – Part 1. Moscow: MCNMO, 2002. 18\. I.I. Bavrin, V.L. Matrosov. General Course of Higher Mathematics. Moscow, Prosveshchenie, 1995 19\. Ilyin V.A., Poznyak E.G. Fundamentals of Mathematical Analysis. Moscow, Nauka, 1971 **Electronic resources:** Republican Interuniversity Electronic Library (RIEL) – (http://rmebrk.kz/) Electronic database of Epigraph publishing – (https://elib.kz/) Electronic library of ARU – (http://neb.arsu.kz/en) Internet library – (https://math.ru/lib/) Internet library of the Moscow Center for Continuous Mathematical Education (Vitaly Arnold) – (http://ilib.mccme.ru/) Electronic portal of multimedia textbooks MU “Epigraph” – (https://mbook.kz/en/index/) Republican Scientific and Technical Library (RSTL) – (http://aktobe.rntb.kz/) Electronic educational physical-mathematical library of the EqWorld website – (http://eqworld.ipmnet.ru/en/library/mathematics.htm)

EP	6B05301 - Physics
Module title	Algebra and Geometry
Semester	2
Responsible Instructor	Bayesheva K.
Language of Instruction	Kazakh
Correlation with the Curriculum	Required component
Forms of Instruction	Lectures, practical exercises, SIWT, IWS

Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 15 hours, SIWT – 15 hours, SIW – 45 hours / 90 hours
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	To master this module, you need knowledge, skills, skills acquired during the study of school courses in algebra, geometry, algebra and analysis initiatives
Module objectives/intended learning outcomes	The aim of the course is to form students' basic mathematical knowledge in accordance with their profession. PO-A, B, C, D, E A. mastering general forms, laws, forms in a separate subject area; B. the ability to independently see systematized results; the ability to fully understand the real essence of fundamental knowledge; C. mastering knowledge in their field at a professional level; D. ability to correctly choose the apparatus and method in the study of simple problems of mathematics; use mathematical knowledge and skills in solving professional problems; E. be able to express mathematical knowledge verbally.
Content	Operations applied to matrices and their properties. Basic properties of determinants. Minors and algebraic complements. Solutions of the system of homogeneous equations. System of linear equations. Matrix equations. Kramer's rule. Gaussian method for solving a system of equations. Vectors. Scalar multiplication. Vector and mixed multiplications. Equation of a line in a plane. Curves of the second order. Planes and straight lines in space. Pages of the second order.
Forms of Instruction	blank test
Requirements for Study and Examinations	Mandatory participation in classroom classes, active participation in the discussion of questions, pre-prepared arrival at lectures and practical classes, high-quality and timely execution of tasks of the SIWT and IWS, participation in all types of control.
References	1. Badaev S. A. Linear Algebra and Analytical Geometry, Almaty: Kazakh University, 2010. 2.Aidos E. Zh. "Higher Mathematics-1", Almaty: Bastau, 2013. 3. Bayarystanov A. O. "Higher Mathematics", Almaty: Nur-Print, 2015. 4. Aubakir S. B. "Higher Mathematics", Almaty: Epigraph, 2016. 5. Bazarbekova A. A. "Higher Mathematics: a collection of problems", Almaty: CyberSmith, 2017. 6. Tokbergenov zh.B." Higher Mathematics", Almaty: Otan, 2015. 7. Kochetkov P. A. " Brief course of Higher Mathematics", m: MGIU, 2009. 8. Makhmedzhanov N. M."Collection of problems of Higher Mathematics", Almaty: ERA, 2008. 9. Kabdykayr "Higher Mathematics: a collection of problems", 2007. 10.Bazarbayeva G. S. "Higher Mathematics: a collection of problems", 2017.

Module title	National Spirituality
Semester	3-4
Responsible Instructor	Begimbayeva Zh.S.
Language of Instruction	Russian
Correlation with the Curriculum	University component (UC)
Forms of Instruction	Lectures, practical classes (seminars), SIWT, SIW

Academic Workload (including Contact Hours and SIW)	Total workload: 90 hours Contact hours: 30 hours (15 hours of lectures, 15 hours of practical classes) Independent study hours, including exam preparation: 15 hours of SIWT, 45 hours of SIW
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	ethnicity, the place of the Kazakh people in history and the modern world, the concepts of national spirituality, national identity, national values, and national self-consciousness.
Module objectives/intended learning outcomes	The course aims to shape a modern personality in a spiritual and moral sense, fostering respect for national and universal values, folk traditions, and the heritage of the Kazakh people.
Content	The course examines the system of spiritual values, Kazakh national existence, the ethnocultural foundations of spirituality, national consciousness, traditions, customs, religious tolerance, rituals, art, references, national upbringing, and traditional culture — all aimed at shaping a broad worldview, kindness, and goodwill toward others, and a commitment to virtuous values. Studying this discipline fosters the development of a spiritually and morally grounded individual, raised with respect for global and universal values, folk traditions, and spiritual heritage.
Forms of Instruction	Computer test
Requirements for Study and Examinations	Mandatory attendance of classroom sessions, active participation in discussions, prior preparation for lectures and practical classes, timely and high-quality completion of SIW assignments, and participation in all forms of assessment.
References	Main References: 1. Tokayev, K.-Zh. Abai and Kazakhstan in the 21st Century // Kazakhstanskaya Pravda, January 9, 2020. 2. Nysanbayev, A.N. The Development of Farabi Studies in Kazakhstan: Results, Problems, and Prospects // Voprosy Filosofii (Problems of Philosophy), No. 5, 2011. – pp. 119–129. 3. Ardakani, R.D. Farabi – the Founder of Islamic Philosophy. Translated from Persian by A. Absalikov. – Moscow: Sadra LLC, 2014. – 132 p. 4. Khoja Ahmed Yassawi // Kazakhstan. National Encyclopedia, Vol. V. – Almaty: Kazakh Encyclopedia, 2006. 5. Balasaguni, Yusuf Khass Hajib // Kazakhstan. National Encyclopedia, Vol. I. – Almaty: Kazakh Encyclopedia, 2004. 6. Kunanbayev, Abai. The Book of Words (Kara Soz). Translated from Kazakh by R. Seysenbayev. – Semipalatinsk, 2001. 7. Twenty Poems by Abai (All known translations, compiled and translated by M. Adibayev). – Almaty, 2005. 8. Abai Kunanbayev. Selected Works (series “Wisdom of the Ages”). – Moscow: Russian Rarity, 2006. 9. Artykbayev, Zh.O. Ethnology and Ethnography: Study Guide. – Astana: Foliant, 2001. – 304 p. 10. Kadirkulova, A.N. Ethnology of the Kazakh People: Educational and Methodological Complex. For specialty 5B050114–History. – Aktobe: Zhubanov Aktobe Regional University RPB, 2014. – 55 p.

EP	6B05301 - Physics
Module title	Mechanics
Semester	2

Responsible Instructor	Amantayeva Amangul Shalkarbaykyzy
Language of Instruction	Kazakh/Russian
Correlation with the Curriculum	Required component
Forms of Instruction	Lecture, practical classes, laboratory classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 15 hours, lab classes – 15 hours, SIWT – 25 hours, SIW – 80 hours / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Mathematical analysis, School course of physics
Module objectives/ intended learning outcomes	Learning objective: to study the general order of motion of bodies (the change in the position of two or more bodies or different parts of the same body in space over a period of time), their balance, and the interactions between them that occur at a given moment. The intended learning outcomes are: 1. Know and understand the laws of kinematics, Newton's laws, types of forces in nature and their effects, work and energy, momentum, conservation laws, AST mechanics, dynamics of rotational motion of a solid body, laws of fluid dynamics, laws of oscillation and waves; 2. Be able to solve problems of varying complexity including kinematics and dynamics and be able to apply mathematical methods to solve mechanical problems. 3. Find the correct relationship between the basic laws and certain specific problems and use them to solve problems in mechanics and other areas of mechanics-related sciences; 4. Develop critical thinking skills in analysing mechanical systems and solving practical problems and be able to work in a team and present the results of their research. 5. The ability to describe and analyse the motion of bodies in different reference systems and an understanding of the principles of static and dynamic equilibrium. 6. Analysis of the results obtained during laboratory work and checking the validity of the report result, filling in tables and graphing the results of the analysis, processing the results, calculating errors, deducing the percentage of deviations from the theory, summarising the results.
Contents	The Mechanics course includes the following: Kinematics; Newton's laws; work and energy; motion under elastic forces; motion under gravitational forces; mechanics of the special theory of relativity; angular momentum; forces of inertia; solid mechanics; mechanics of elastic forces; Hydrostatics and aerostatics; Hydrodynamics and aerodynamics; natural functions of systems with multiple degrees of freedom oscillations; waves; Acoustics.
Forms of Instruction	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 (SIWT assignments, 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. Kulshykova, A., Ibrayeva, G. Mechanics: A Brief Collection of Lectures. – Aktobe: K. Zhubanov Aktobe Regional University, 2016. – 90 p. 2. Akylbaev, Zh., Gladkov, V., Ilina, L., Turmukhambetov, A. Mechanics: Textbook. 2nd ed. – Astana: Foliant, 2011. – 360 p. 3. Irodov, I.E. Mechanics. Basic Laws: Textbook / transl. by N.A. Mazhenov, Yu.M. Smirnov, B.M. Kenzhin. – Almaty, 2012. – 276 p. 4. Spabekova, R.S. Mechanics: Textbook. – Karaganda: Medet Group LLP, 2017. – 156 p. 5. Abduramanov, A. Fluid Mechanics: Textbook. 2nd ed. – Karaganda: Medet Group LLP, 2020. – 266 p. 6. Koishybayev, N. Mechanics. Volume I: Textbook. – Almaty: Ziyat Press, 2005. – 498 p. 7. Aymaganbetova, Z.K., Serikbayeva, G.D., Shunkenov, K.Sh. Mechanics: Laboratory Manual. – Aktobe, 2010. – 93 p.

Module title	Philosophy
Semester	2
Responsible Instructor	Senior Lecturer: Aynur Chapaevna Eshniyazova
Language of Instruction	Kazakh
Correlation with the Curriculum	Profile discipline, university component
Forms of Instruction	Lectures, practical classes, SIWT, SIW
Academic Workload (including Contact Hours and SIW)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical classes) Independent study, including exam preparation: 25 hours of SIWT, 80 hours of SIW
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	To successfully master the course in Philosophy, no special prior training is required, but having some basic knowledge and skills is beneficial. These include reading and text comprehension skills, critical thinking, the ability to analyze arguments, identify logical fallacies, and formulate one's own viewpoint, as well as literacy and the ability to articulate thoughts clearly. An interest in questions such as "why" and "for what purpose" is also helpful. Philosophy begins with a sense of wonder and a desire to understand the deeper causes of phenomena, the meaning of life, justice, truth, and so on.
Module objectives/ intended learning outcomes	The goal of the Philosophy course is to develop students' ability for critical thinking, in-depth analysis, and understanding of fundamental questions concerning existence, knowledge, morality, consciousness, and society. The course is aimed at: ✔ Developing skills in argumentation and logical reasoning — the ability to construct, analyze, and evaluate arguments. ✔ Cultivating independent thinking — understanding different viewpoints and forming one's own position. ✔ Introducing key philosophical traditions and concepts — such as being, epistemology, ethics, philosophy of mind, and more. ✔ Understanding the historical context of the development of philosophical thought — from antiquity to contemporary philosophy.
Contents	The core Philosophy course material is presented in the form of a concise lecture course, which nonetheless covers a wide range of the most important philosophical topics outlined in the state educational standard. The study guide

	includes precisely those questions that are typically asked during exams to assess students' understanding and depth of knowledge of the course. Philosophical issues are analyzed in close connection with humanism, legal consciousness, and other forms of spiritual and value-based engagement with reality. The course is designed to help students, through their knowledge of philosophical content, develop their own philosophical standpoint and independently navigate complex, essential life issues.
Forms of Instruction	Computer test
Requirements for Study and Examinations	Learning Requirements (throughout the semester): Attendance of classes and regular participation in lectures and seminars are mandatory. Students are expected to be active during seminars, study philosophical texts, and read primary sources. Preparation for the discussion of key ideas in seminars is required, as well as writing assignments such as essays, reports, or analytical notes on course topics. Participation in all forms of assessment is also compulsory.
References	**Main References:** 1. Khasanov, M.Sh. Philosophy (with sign language interpretation) — textbook recommended by Al-Farabi Kazakh National University; corresponds to the standard curriculum of the Ministry of Education and Science of the Republic of Kazakhstan. 2. Abisheva, A.K. Philosophy — textbook for undergraduate, master's, and PhD students of higher educational institutions, edited by Z.K. Shaukenova. 3. Nurysheva, G.Zh. Philosophy — textbook published in Almaty, 2013. 4. Petrova, V.F., Khasanov, M.Sh. Philosophy — textbook published in Almaty, 2014. 5. Barlybayeva, G.G. The Evolution of Ethical Ideas in Kazakh Philosophy — research monograph published in Almaty, 2011. 6. Segizbayev, O.A. History of Kazakh Philosophy — book translated by G.Zh. Nurysheva and M. Sabit, published in 2017. 7. Begalinova, K.K., Alzhanova, U.K. Philosophy (Parts 1 and 2) — study guide published in Almaty, 2014. 8. Masalimova, A.R., Altaev, Zh.A., Kasabek, A.K. Kazakh Philosophy — study guide published in Almaty, 2018. 9. Hess, R. 25 Key Books in Philosophy — book published in 1999. 10. Johnston, D. A Brief History of Philosophy — published in 2010. 11. Johnston, D. A Brief History of Philosophy: From Socrates to Derrida. – London: A&C Black, 2006. – 211 p. 12. Kenny, A. New History of Western Philosophy. Volumes 1–4. – Oxford: Oxford University Press, 2006–2010. 13. Humphreys, P. The Oxford Handbook of Philosophy of Science. – Oxford: Oxford University Press, 2016. 14. Estlund, D. The Oxford Handbook of Political Philosophy. – Oxford: Oxford University Press, 2017. 15. Cappelen, H., Gendler, T., Hawthorne, J. The Oxford Handbook of Philosophical Methodology. – Oxford: Oxford University Press, 2016.

Module title	BBE 2108 Basics of Business and Entrepreneurship
Semester	2
Responsible Instructor	Duissenbayeva B.B.
Language of Instruction	Kazakh/Russian
Connection with the curriculum	Elective component

Forms of Instruction	Lectures, practical classes, SIWT (Independent Work with the Teacher), SIW (Independent Work of Students).
Academic load (including contact hours and SIW/Students' Independent Work	Academic workload (including contact hours, SIW) Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical classes) Independent study, including exam preparation, in hours: 25 hours of SIWT (Independent Work with the Teacher), 80 hours of SIW(Independent Work of Students)
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	To master this module, knowledge, skills, and competencies gained from studying the following course are required: *Basics of Entrepreneurship*.
Module objectives / **Intended** learning outcomes	Study of the conceptual foundations of business, development of entrepreneurial thinking, and basic skills in developing one's own business. Learning outcomes: 1. Understand the essence of economic phenomena and processes, and know and comprehend the theory of entrepreneurship. 2. Apply in practice the peculiarities of various legal forms of business organization. 3. Formulate different aspects of ensuring the functioning of a business. 4. Evaluate the achieved results of the economic activity of an enterprise. 5. Master methods of analyzing the impact of various factors on business development.
Content	The course provides practical training in business thinking psychology, skills in choosing a business idea, learning business models and planning core entrepreneurial activities, skills in working with the target audience in marketing and entrepreneurship, sales strategies, and management of entrepreneurial resources. It also covers methods of designing financial models and attracting investments, as well as the basics of tax and legal literacy and the responsibilities of entrepreneurs. The program is practice-oriented, allowing students to work independently on their own startups while studying the course. Additionally, the program utilizes the case method, demonstrating the ability to apply acquired knowledge through examples from active Kazakhstani and international companies.
Form of the examination	Computer test
Training requirements and examinations	1. Everyone must attend classes and arrive on time. 2. If you cannot attend due to a valid reason, you must inform in advance. 3. Assignments must be submitted on time. 4. Be able to argue your point of view, strive for professional growth, and possess skills in working with references. 5. Late assignments will not be accepted.

References	**Main references:** 1. Kuratko, Donald F. *Entrepreneurship: Theory, Process, Practice*. – Almaty: Public Foundation "National Translation Bureau". – 2019. – 514 p. 2. Shalbolova U.Zh., Baizholova R.A., Egemberdieva S.M., Ryspekova M.O., Rakhmetulina Zh.B. *Basics of Entrepreneurship: A Textbook* / Edited by Shalbolova U.Zh. – Almaty, Evero, 2018. – 236 p. Link 3. *Methodological Guide: Student Workbook "Basics of Entrepreneurship"* / E.S. Duysenhanov, N.E. Zhuldyzbaev, A.S. Uspaeva, A.S. Utepkalieva, S. Atageldinova, G.E. Kerimbek – NPP "Atameken" – Nur-Sultan: Public Organization "Young Disabled People of the City of Astana", 2019. – 206 p. 4. Isabekov B.N. *Innovation and Entrepreneurship: A Textbook* / B.N. Isabekov, L.K. Mukhambetova. – Almaty: "Evero" Publishing House, 2016. – 592 p. Link 5. *Business Organization, Vol. II: Study Guide* / A.M. Balkybaeva, N.V. Kishko, R.A. Karabasov, et al. – Almaty: Bastau, 2020. – 392 p. 6. *Entrepreneurship: Creating a Business – Basics* / Chris Nguyen – KIMEP University Publications, 2015. Link **Additional references:** 1. Mamytova S.N. *History of Entrepreneurship in Kazakhstan in the Second Half of the 19th – Early 20th Century*. – Almaty, EVERO, 2018. – 324 p. Link 2. Duysenhanov E.S., Shcheglov S.A., Khanin D., Seitenova A.A. *Basics of Entrepreneurship and Business*. Electronic Textbook. – Almaty: "Kokzhiek-Horizon", 2019. Link 3. Lipovka, A.V. *Social Entrepreneurship as a Key to Increasing Social Responsibility in the Republic of Kazakhstan*. // *Social Entrepreneurship in Kazakhstan: Materials of the International Scientific-Practical Conference "Development of Social Entrepreneurship in Kazakhstan"*, Almaty, February 27, 2015. – Almaty, 2015. – pp. 74–77. Link 4. Osterwalder, A., Pigneur, I. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Link **Electronic resources:** 1. https://demeufund.kz/ - KMF-Demeu 2. http://e.gov.kz - Official website of the Electronic Government of Kazakhstan 3. https://afk.kz/ - Association of Financiers of Kazakhstan (AFK) 4. https://amanatpartiasy.kz/?lang=ru - "Amanat" Party 5. https://epigraph.kz/ - Epigraph electronic textbook database 6. http://rmebrk.kz/resources - Republican Inter-University Electronic Library 7. http://kazneb.kz – Kazakh National Electronic Library 8. http://aktobe.rntb.kz – Aktobe Branch of the Republican Scientific and Technical Library 9. https://openu.kz/kz - Kazakh Open University 10. https://aknurpress.kz/login - Digital Library AKNURPRESS

EP	6B05301 - Physics
Module title	Molecular Physics
Semester	3
Responsible Instructor	Sharipov Samat, Master of Physics, senior Lecturer

Language of Instruction	Kazakh
Correlation with the Curriculum	Required component
Forms of Instruction	PBL, teamwork, flipped classroom, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, lab classes – 10 hours, SIWT – 25 hours, SIW – 80 hours (lecture, lesson, labworks, project, seminar etc.) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Mathematical analysis, mechanics, school physics course, ICT
Module objectives/intended learning outcomes	Module objective: The study of the physical properties of substances in different states of aggregation according to their molecular structure. Learning outcomes: 1. To know the basic concepts, laws and models of general theoretical physics, to present and interpret the result competently, seeing the applied aspect in solving a scientific problem; 2. To formulate the main results of fundamental and applied research in the field of physics and mathematics as a phenomenon under study or a theory related to the law; 3. Organization of educational and research work, academic writing, methodically competent performance of a physical experiment; 4. Equilibrium macroparameters, pressure and temperature, statistical method, static ensemble, Maxwell distribution, basic equation of kinetic theory of gas, gas laws, first and second principles of thermodynamics, adiabatic process, cyclic process, knowledge and understanding of entropy; 5. Find the right balance between the basic laws and individual specific problems and use them to solve problems in molecular physics and other fields of thermodynamics and related sciences in physics; 6. Analysis of the results obtained during laboratory work; 7. Checking the reliability of the report result, filling in tables and plotting the analysis results, processing the results, calculating errors, deducing the percentage of deviations from theory, summarizing.
Content	Molecular physics is a branch of physics that studies the physical properties of bodies taking into account their molecular structure. The course deals with the following issues: aggregate states of matter, basic equations and basic States of the molecular-kinetic theory of gases, the equation of the ideal gas state, the speed of propagation of molecules, the work of increasing gas, heat capacity, the first, second and third laws of thermodynamics, adiabatic and polytropic processes, Carnot cycle, entropy.
Forms of Instruction	Orally
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. Spabekova R. S. Molecular physics: a textbook. Karaganda:" Medet Group " LLP, 2017. - 152 P. 2. Korazov T. A., Sarsenbayev B. O. Fundamentals of Molecular Physics and thermodynamics. Training manual. 2014 p.338 3.Balabekov K. N., Balakhaeva R. K., Kaynarbay A. Zh. Molecular Physics and thermodynamics. Part 1. Training manual. - Almaty: epigraph, 2019. -340 P.

	4.Balabekov K. N., Balakhaeva R. K., Kaynarbay A. Zh. Molecular Physics and thermodynamics. Part 2. Training manual. - Almaty: epigraph, 2019.-128 P. 5. Salihoja Zh. M. Workshop of Molecular Physics: educational and methodical manual./ - Almaty, Evero, 2018. - 92 P. 6. Ilyasov N. Collection of problems of Molecular Physics. - Almaty: "Nur-Print". 2012. - 237 P. 7. Bizhigitov T. Static physics. Fundamentals of physical Kinetics. - Almaty: LLP "era", 2011 – - 120 P. 8. Robert H., Christian B. Thermodynamics and static mechanics. The textbook. - Almaty, 2016.

EP	6B05301 - Physics
Module title	Electricity and Magnetism
Semester	3
Responsible Instructor	Shanina Zamzagul Kuatovna
Language of Instruction	Kazakh/Russian
Correlation with the Curriculum	Required component
Forms of Instruction	PBL, teamwork, flipped classroom, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 20 hours, practical classes – 15 hours, labworks – 5 hours, SIWT – 20 hours, SIW – 60 hours (lecture, lesson, labworks, project, seminar etc.) / 120 hours
ECTS	4
Required and Recommended Prerequisites for Taking the Module:	Mechanics, Molecular physics, Mathematical analysis.
Module objectives/intended learning outcomes	Learning objective: To train specialists who are well versed in the fundamentals of the physics of electromagnetic phenomena, ensuring the professional quality of future physics. The intended learning outcomes are: 1. Mastering modern methods and technologies of teaching and education in physics and computer science. 2. To form students' research work and academic writing skills, to teach them how to perform physical experiments methodically and competently. 3. Knows and understands the theory and laws of electrostatics, direct current, magnetic field, magnetic field in matter, electric current in various environments, alternating current, electromagnetic oscillations and currents. 4. Uses them in observations, solving typical problems, performing laboratory work, and studying environmental phenomena. 5. Can select theoretical data and problem-solving methods, conduct research. 6. Can check the correctness of the calculation results, fill in tables and graphs based on the analysis results, process the results, calculate errors, calculate the percentage of deviation from the theory, draw conclusions, defend and explain the work. 7. Can assess the role of electrical and magnetic phenomena in solving current theoretical and practical problems of physics (in engineering calculations, electronics, electrical engineering, computing).
Content	The Electrisity & Magnetism course includes the following: Electrostatic field. Electrostatic field in conductors. Electrostatic field in dielectrics. Electrostatic field energy. Laws of direct current. Kirchhoff's rules. Electrical conductivity of metals. Electrical conductivity of liquids. Electrical conductivity of gases.

	Magnetic field of direct current. Magnetic field in magnets. Electromagnetic induction phenomenon. Quasi-stationary alternating current. Work and power of alternating current. Displacement current Maxwell's equations. Radiation of electromagnetic waves
Forms of Instruction	Orally
Requirements for Study and Examinations	- obtaining quality knowledge; - fulfil the teacher's requirements specified in the syllabus; - independently complete all types of work (SIWT assignments, 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. Bayimbetov F.B., Ramazanov T.S. Electricity and magnetism. – Almaty: Kazakh University, 2011 2. Akylbaev Zh.S., Ermagambetov K.T. Electricity and magnetism. Karaganda: KarMU Publishing House, 2003 3. Spabekova R. S. Electricity and magnetism - Karaganda: Medet Group, 2017. 4. R. S. Spabekova, G. Sh. Omashova. Mechanical and electromagnetic oscillations and waves - Karaganda: Medet Group, 2020. 5. Savelyev I. V. General physics course: 2 volumes: Electricity - Almaty: School, 2004. 6. Daribekov S. Special chapters of the electricity and magnetism course - Karaganda: Ak Nur, 2012. 7. I.E. Irodov. Electromagnetism: Basic laws. – Almaty, 2013. 8. M. Kulbekov, G. Alimbekova, K. Nurgaliyeva. General Physics Course. Electricity and Magnetism - Almaty: Republican Publishing House, 1997

EP	6B05301 - Physics
Module title	Physics Practicum
Semester	3
Responsible Instructor	Abdrakhmanov A.E.
Language of Instruction	Kazakh
Correlation with the Curriculum	Elective
Forms of Instruction	PBL, teamwork, flipped classroom, etc.
Academic Workload (including Contact Hours and SIW)	Practical classes – 40 hours, SIWT – 20 hours, SIW– 60 hours (lecture, lesson, labworks, project, seminar etc.) / 120 hours
ECTS	4
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Mechanics, Molecular Physics, Electricity and magnetism, Optics, Physics of the atom and atomic nucleus
Module objectives/intended learning outcomes	Module objective: The discipline is aimed at the formation and constant control of the knowledge, skills and abilities of future teachers in the school physics course, which provides kinematics, dynamics, statics; mastering various methods of solving problems (analytical, graphical, experimental, etc.). Learning outcomes: 1. to recognize and understand fundamental scientific concepts that have fundamental methodological and theoretical significance for

	understanding and mastering the physical sciences, to argue their own position of applying and integrating knowledge from other fields of sciences to solve global and local problems of physics; 2. conduct integrated lessons with STEAM-learning elements, use CLIL technologies for subject-language teaching of natural subjects; 3. understand the scientific principles and logic of developing a school physics course, apply various learning technologies in their diversity and to the place.
Content	To master this discipline, the student uses knowledge, skills, and abilities formed as a result of mastering disciplines such as mechanics, molecular physics, electricity and magnetism, optics, atomic and nuclear physics, etc. In the course of studying the discipline, the knowledge gained during the development of these courses is generalized, the interrelation and mutual influence of various disciplines is shown, and the professional orientation of the educational process is realized.
Forms of Instruction	Orally
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. A short course in physics with examples of problem solving: a textbook, 2010, T.I. Trofimova. 2. Collection of physics course problems with solutions: A textbook. 2007. Trofimova, T.I. https://rmebrk.kz/book/86928 3. Methods of solving problems in physics, 1972, Kobushkin V.K. https://neb.arsu.kz/kk/view?rid=3839&fid=3813 4. Solving problems in physics. Part 1. 1993, N. Parfentieva, M. V. Fomina 5. Collection of problems in physics. Molecular physics. Thermodynamics. Electrostatics. Direct current. Magnetic field, 1999, Rusakov A.V. Sukhov V.G. http://neb.arsu.kz/kk/view?rid=3859&fid=3835 6. Methodological recommendations: seminars on the theory and methodology of teaching physics, 2010, I.F. Spivak-Lavrov et al. 7. Collection of problems in the general physics course. Volkenstein V.S. Moscow, 1985. 8. Collection of problems in the course of general physics. Edited by M.S.Tsedrik, Moscow, 1989. 9. Collection of problems in elementary physics. Bukhovtsev, Myakishev et al., 1974. 10. Collection of problems in physics. Molecular physics. Thermodynamics. Electrostatics. Direct current. The magnetic field. Rusakov A.V. Sukhov V.G.Sergiev 1999

EP	6B05301 - Physics
Module title	Theoretical mechanics
Semester	4
Responsible Instructor	Shanina Zamzagul Kuatovna
Language of Instruction	Kazakh/Russian

Correlation with the Curriculum	elective course component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Lectures – 30 hours, practical classes – 15 hours, SIWT – 25 hours, SIW – 80 hours (lecture, lesson, labworks, project, seminar etc.) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Mathematical analysis, Differential equations, "Mechanics" course.
Module objectives/ intended learning outcomes	Learning objective: To teach students the basic ideas of theoretical mechanics, including the physical basis of the predictions of classical mechanics, and modern ideas about space and time, the important role of conservation laws and their connection with the properties of space and time and the symmetry of force fields, and to teach students to solve various problems in the motion of material points and rigid bodies by mastering various methods of analytical mechanics. The intended learning outcomes are: 1. Knowledge of the basic concepts, laws and models of general theoretical physics, competent presentation and interpretation of the results, seeing the applied aspect in solving scientific problems. 2. Ability to formulate the main results of fundamental and applied research in the field of physics and mathematics as a theory related to the phenomenon or law being studied. 3. Ability to use mathematical knowledge and methods to solve practically-oriented problems, analyze quantitative data presented in the form of graphs, diagrams, statistical information analysis, use mathematical methods in the analysis and synthesis of observed physical processes, facts and phenomena. 4. Ability to analyze problems by classifying them in the course of research and know methods for solving them. 5. Ability to check the correctness of the results of the calculation, fill in tables and graphs based on the analysis results, process the results, calculate errors, calculate the percentage of deviation from the theory, draw conclusions, defend and explain the work. 6. Assess the role of the laws of theoretical mechanics in solving current theoretical and practical problems of physics (physical transitions, critical phenomena, astrophysics, biophysics).
Content	Basic concepts and axioms of statics. Addition of forces. System of cumulative forces. Theory of moments. Reduction of a system of forces to a given center. Any system of forces in a plane. Friction. System of forces in space. Center of gravity. Kinematics of a material point. Vector and coordinate methods of describing motion. Kinematics of a rigid body. Complex motion of a material point. Newton's laws. Galileo's principle of relativity Differential equations of motion of a material point. Basic theorems of dynamics. Dynamics of a mechanical system. Moments of inertia. General theorems of the dynamics of a mechanical system. Relations and their classification. Lagrange's function and Lagrange's equation. Hamilton's function and Hamilton's equations.
Forms of Instruction	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 (SIWT assignments, 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. Adyrbekov M.A. Theoretical mechanics, 2018. - http//elib.kz 2. Torekozhaev A. N., Tuganbayeva D. T., Kyrykbaev B. Zh.. Theoretical mechanics. Almaty, 2019. - 502 pages. 3. Alimzhanov M.D., Duzelbaev S.T., Tuyakbaev Sh.T. Theoretical mechanics, 2018. - http//elib.kz 4. Imanbayeva L.Kh. Theoretical mechanics: Textbook, 2019. - http//elib.kz 5. Odiyak B.P., Nametkulova R.Zh., Kadirimbetova A.K. Problems and exercises of the general physics course (fundamentals of classical mechanics, molecular physics and thermodynamics) Part 1, 2020 - http//elib.kz 6. Inkarbekov A. Theoretical mechanics: dynamics: Textbook. - Almaty: Bastau, 2012. - 292 pages. 7. Kurenkeev T.B. Theoretical Physics Course: 1 book. Theoretical Mechanics. Textbook. - Almaty: Evero, 2017. - 106 pages 8. Kairbayev K.K. Fundamentals of classical mechanics. Textbook. - Pavlodar: PSPI Publishing House, 2006. - 176 p. 9. Zholdasbekov O.A., Akhmetov A.K. Collection of theoretical mechanics problems. Textbook. - Almaty: Nauka, 2003. - 394 p. 10. Kozhakhmetova A.K. Theoretical mechanics (collection of problems and examples of solving problems). Textbook, 2003. - 185 p. 11. Abishev M.E. Lecture notes on theoretical mechanics. - Almaty: Kazakh University, 2009. - 128 p. 12. Toybayev S.N., Yerzhanov N.M. Theoretical and applied mechanics. - Almaty: IP "Otan", 2015. - 360 p. 13. Meshchersky I.V. Collection of problems on theoretical mechanics. Uch. allowance. - St. Petersburg: Izd-vo "Lan", 2005. 14. Toibaev S.N. The basis of theoretical mechanics. - Almaty: IP "Otan", 2016. - 76 p. 15. Kepe, O.E. Collection of short problems in theoretical mechanics. - M., 2012. - 620 c. 16. Arkusha A.I. Guide to solving problems in theoretical mechanics. - M.: VSH, 2003. - 336 p. 17. Zhirnov N.I. Classical mechanics. - M., 1980. - 811 c

EP	6B05301 - Physics
Module title	Differential and Integral Equations
Semester	3
Responsible Instructor	Tokmurzin Zh.S. Senior lecturer. PhD
Language of Instruction	Kazakh / Russian
Correlation with the Curriculum	Elective
Forms of Instruction	Lectures, Practical Sessions, Instructor-Guided Independent Work (IGIW), Self-Directed Learning (SDL)
Academic Workload (including Contact Hours and SIW)	Lectures – 20 hours, practical classes – 20 hours, SIWT – 20 hours, SIW – 60 hours (lecture, lesson, labworks, project, seminar etc.) / 120 hours
ECTS	4

Required and Recommended Prerequisites for Taking the Module:	To successfully complete this module, students should have foundational knowledge and competencies gained from the following courses: Higher mathematics
Module objectives/intended learning outcomes	A. Be able to make partial differential equations of the first order, solved depending on the derivative; B. Approximate the solution of differential equations and calculate their values. C. To know the similarities of different meanings and be able to find examples related to the study of their relations. D. Partial derivatives of first-order differential equations and mastering their properties. F. Stability of solutions to know and prove
Content	Partial derivatives of first-order equations are basic concepts. Classification of equations autonomous first-order derivative linear equation homogeneous linear equation homogeneous linear equation for the Cauchy problem Quasiparticle equations.
Forms of Instruction	Blank test
Requirements for Study and Examinations	Regular attendance in both online and in-person classes is mandatory. Students are expected to engage actively in the discussion of course topics, demonstrate preparedness for lectures and practical sessions, and complete all Independent Study (IS) assignments with high quality and within set deadlines. Participation in all forms of assessment, including formative and summative evaluations, is required.
References	Kölekeev K.D., Nazarova K.Zh. Differential Equations. Almaty, 2012. Orynbasarov M., Sakhaev Sh. Course of Integral Equations. Almaty, 2014. Steven Krantz. Differential Equations (Mathematics Textbooks), 1st Edition. 2020. Paul Blanchard, Robert L. Devaney, Glen R. Hall. Differential Equations, Fourth Edition. Boston University, 2012. – 859 p. Suleymen Zh. Course of Differential Equations. Almaty, 2009. Ashirbayev N.K. Ordinary Differential Equations. Almaty: Evero, 2014. – 228 p. V.I. Arnold. Ordinary Differential Equations. Moscow: MCNMO Publishing, 2012. – 344 p. V.D. Gunko, L.Yu. Sukhoveeva, V.M. Smolentsev. Differential Equations: Examples and Typical Problems. Study guide. Krasnodar, 2005. – 105 p.

Module title	MMF 3301 Methods of Mathematical Physics
Semester	3
Responsible Instructor	Turganbayev A.A.
Language of Instruction	Kazakh/ Russian
Correlation with the Curriculum	Profile discipline, university component
Forms of Instruction	Lectures, practical classes, SIWT , SIW
Academic Workload (including Contact Hours and SIW)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical classes) Independent study, including exam preparation: 25 hours of SIWT, 80 hours of SIW
ECTS	4
Required and Recommended Prerequisites for Taking the Module:	To master this module, students need the knowledge, skills, and competencies acquired in the following courses: Algebra and Geometry, Mathematical Analysis, and Differential Equations.

Module objectives/intended learning outcomes	Course Objective: The aim of the course is to study the fundamental concepts and provide an understanding of the theoretical foundations of the methods of mathematical physics. The course introduces the field of application of mathematical physics and the methods used to construct mathematical models of certain physical processes. It also aims to develop practical skills in solving partial differential equations and to teach students how to apply key analytical methods for solving boundary value problems involving partial differential equations. Learning Outcomes – RO 3, 4, 5: A. Know and understand the basic concepts and methods of mathematical physics. B. Use the main classical methods to solve the specified problems and acquire practical skills for solving problems that describe patterns of various physical phenomena. C. Be capable of applying fundamental methods to find solutions to initial and boundary value problems for differential equations, and formulate conclusions that describe the patterns observed in these problems. D. Be able to develop a general understanding of differential equations, gather, process, and work with relevant information. Be capable of working in a team, proposing new solutions, and striving for professional and personal growth. E. Apply knowledge and skills competently, recognize the social importance of the future profession, stay motivated to carry out professional activities, and take responsibility for the outcomes of such activities.
Content	Partial Differential Equations. Key Concepts: Basic definitions of partial differential equations (PDEs). Fundamental equations of mathematical physics. Vector and Scalar Fields. Scalar field. Directional derivative. Gradient. Vector field. Vector lines. Vector field flux. Divergence of a field. Ostrogradsky-Gauss (Divergence) Theorem. Circulation. Stokes' Theorem. Classification and Canonical Form. Classification of second-order PDEs. Reduction to canonical form. Wave Equation: Vibrating string equation. Boundary value problems. Cauchy problem for the wave equation. Fourier method for solving boundary value problems for hyperbolic equations. Eigenfunctions and eigenvalues. Heat Equation: Heat conduction equation. Cauchy problem for the heat equationPoisson’s formula. Separation of variables method for solving the heat equation. Fundamental solution of the heat equation. Solution of the Cauchy problem for the heat equation. Elliptic Equations: Laplace and Poisson equations. Harmonic functions. Solution of the Dirichlet problem for a circle and a sphere. Poisson’s formula. Exterior Dirichlet problem
Forms of Instruction	Blank test
Requirements for Study and Examinations	Mandatory attendance of in-class sessions, active participation in discussions, prior preparation for lectures and practical classes, high-quality and timely completion of SIW assignments, and participation in all forms of assessment are required.

References	Main References: 1. Bizhigitov, T. Methods of Mathematical Physics. Textbook. – Almaty, 2014 2. Ramazanov, M.I., Mukhtarov, M., Adilbek, N. Fundamental Equations of Mathematical Physics. Study guide. – Karaganda: ZhK "Ak Nur Publishing", 2013. 3. Tokybetov, Zh.Ä., Khairullin, Ye.M. Equations of Mathematical Physics. – Astana, 2015. 4. Orynbasarov, M., Sakhaev, Sh. Collection of Problems and Exercises on Equations of Mathematical Physics. – Almaty: Kazakh University, 2015. 5. Sarsekeeva, A.S. Equations of Mathematical Physics. – Almaty: Kazakh University, 2015. RMEb. 6. Tikhonov, A.N., Samarsky, A.A. Equations of Mathematical Physics. – Moscow: Moscow State University – Nauka, 2014. 7. Ilyin, A.M. Equations of Mathematical Physics. – Moscow: Fizmatlit, 2019. 8. Mamontov, A.E. Lectures on Equations of Mathematical Physics. Part 1: Elements of General Theory of Partial Differential Equations. Study guide. – Novosibirsk: NSPI, 2016. 9. Mamontov, A.E. Lectures on Equations of Mathematical Physics. Part 2: Classical Solutions. Study guide. – Novosibirsk: NSPI, 2014. 10. Emelyanov, V.M., Rybakina, Ye.A. Equations of Mathematical Physics: Problem-Solving Practice. 2nd ed. – St. Petersburg: Lan, 2016. 11. Vladimirov, V.S. Equations of Mathematical Physics. – Moscow: Fizmatlit, 2015. 12. Koshlyakov, N.S., Gliner, E.B., Smirnov, M.M. Partial Differential Equations of Mathematical Physics. – Moscow: Vysshaya Shkola, 2017. 13. Budak, B.M., Tikhonov, A.N., Samarsky, A.A. Problem Book on Mathematical Physics. – Moscow: Fizmatlit, 2014. 14. Pikulina, V.P., Pokhozhaev, S.I. Practical Course on Equations of Mathematical Physics. – Moscow, 2016. 15. Blinova, I.V., Popov, I.Yu. Basic Equations of Mathematical Physics. Study guide. – St. Petersburg: ITMO University, 2019. 16. Vladimirov, V.S. (ed.). Problem Book on Equations of Mathematical Physics. – Moscow: Fizmatlit, 2003. 17. Vladimirov, V.S., Zharinov, V.V. Equations of Mathematical Physics: University Textbook. – Moscow: Fizmatlit, 2004. 18. Korzyuk, V.I. Equations of Mathematical Physics. – Minsk: Belarusian State University, 2010. 19. Ochan, Yu.S. Problem Book on Methods of Mathematical Physics. – Moscow: Vysshaya Shkola, 1973. 20. Mamontov, A.E., Mamontov, Ye.V. Problem Book on Equations of Mathematical Physics. Study guide. – Novosibirsk: Novosibirsk State University, 2016. 21. Shubin, M.A. Lectures on Equations of Mathematical Physics. – Moscow: MCCME, 2013. 22. Kostin, A.B., Tikhonov, I.V., Tkachenko, D.S. Equations of Mathematical Physics. Practice Guide, Part II. – Moscow, 2008. 23. Pichugin, B.Yu., Pichugina, A.N. Equations of Mathematical Physics: Lecture Course. – Omsk: Publishing House of Omsk State University, 2016.

EP	6B05301 - Physics
Module title	Programming

Semester	3
Responsible Instructor	Ryskul Uteuovna Zhakina
Language of Instruction	Kazakh
Correlation with the Curriculum	Basic discipline, university component
Forms of Instruction	Lectures, practical and laboratory sessions, SIWT, SIW
Academic Workload (including Contact Hours and SIW)	Total Workload: 120 hours Contact Hours: 45 hours (15 hours of lectures, 15 hours of practical classes, 10 hours of laboratory work) Independent Study, including exam preparation: 20 hours of SIWT, 60 hours of SIW
ECTS	4
Required and Recommended Prerequisites for Taking the Module:	To master this module, students must have knowledge, skills, and competencies acquired in the course Information and Communication Technologies
Module objectives/intended learning outcomes	The aim of the course is to develop an understanding of the main levels of problem-solving on a computer, the concept of algorithms and their representation methods, types of algorithms, principles of processing and searching, and their software implementation, as well as dynamic data structures, software development methods, programming style, quality indicators of programming, and methods for testing and forming programs. The course also aims to develop students' knowledge and skills in preparing effective algorithms for solving various problems, promoting the acquisition of both fundamental data processing algorithms and modern new algorithmic methods. Learning Outcomes (LO) - 3, 4, 5: 3. To be able to develop various programs by using fundamental computational algorithms and their properties, transforming them into linear, branching, and cyclic types of algorithms. 4. To be able to independently develop and implement standard algorithms in C++, perform array processing using various internal sorting methods, and develop software implementations of abstract data structures. 5. To be able to evaluate algorithmic methods and software solutions in the field of system and application programming, assess the significance of the course material, and the consistency of conclusions. Upon completion of the course, students should know: The programming paradigm, structural features, and algorithmic methods, and be able to understand them. How to apply algorithmic methods and modern software, as well as modern computing techniques, to solve problems.

Content	The course is aimed at preparing students for their future professional activities—teaching mathematics in schools of various profiles. Mastering the discipline also serves as a foundation for successfully completing pedagogical practice. Programming is a subject focused on creating programs for computers. In the modern world, it is essential for a specialist to understand the principles of computer operation and the possibilities of software support. The course "Programming" is designed to develop knowledge of the basic concepts of algorithmization and programming, algorithms and data structures, methods for constructing algorithms, algorithm analysis, methods and technologies for writing programs, as well as various algorithms for internal data sorting and search problems. During the study of the course, the algorithms considered will cover the properties and conditions of potentially useful algorithms, while also linking to the theory of algorithms and computational systems, as well as examining the efficiency of algorithms.
Forms of Instruction	oral
Requirements for Study and Examinations	Mandatory attendance of online and in-class sessions, active participation in discussions, prior preparation for lectures, practical and laboratory classes, high-quality and timely completion of independent work assignments, and participation in all types of assessments.

References	Main References: 1. Pavlovskaya, T.A. C/C++. Programming in a High-Level Language: Textbook. – Almaty: Dauir Publishing House, 2013. – 504 p. 2. Pavlovskaya, T.A. C/C++. Procedural and Object-Oriented Programming. University Textbook. Third Generation Standard. – St. Petersburg: Piter, 2021. 3. Boribaev, B.B., Makhmetova, A.M. Algorithms and Programming Languages: Textbook. – Almaty: LLP RPBK "Dauir". – 328 p. (http://rmebrk.kz/bilim/association/boribaev-algoritmdeu.pdf) 4. Zhoranova, N.Zh. Fundamentals of High-Level Programming Languages: Study Guide. – Almaty: CyberSmith, 2017. – 296 p. 5. Smailova, U.M. Programming: Algorithm Development Technologies: Study Guide. – Almaty: Asyl Kitap. 6. Shevchuk, E.V. Collection of Problems and Exercises on Data Structures and Programming: Study Guide, 2014. 7. Koksengen, A.E., Seifullina, A.O. Algorithms and Programming Languages: Textbook / Ministry of Education and Science of the Republic of Kazakhstan. – Almaty: LLP RPBK "Dauir". – 191 p. – (Association of Higher Education Institutions of the Republic of Kazakhstan). 8. Kemelbekova, Zh. Programming Languages and Technologies: Study Guide. – Almaty: TechSmith, 2019. – 284 p. 9. Lafore, R. Object-Oriented Programming in C++ / R. Lafore. – St. Petersburg: Piter. 10. Stroustrup, Bjarne. Programming: Principles and Practice Using C++. Vol. 1 / Translated by B. Boribaev, M. Abdrakhmanova. – Almaty, 2013. 11. Stroustrup, Bjarne. Programming: Principles and Practice Using C++. Vol. 2 / Translated by B. Boribaev, S. Adilgazinova. – Almaty, 2014. 12. Pavlovskaya, T.A. C/C++. High-Level Programming for Master's and Bachelor's Students: Textbook / T.A. Pavlovskaya; Third Generation Standard. – St. Petersburg: Piter, 2021. 13. Shevchuk, E.V. Programming in C++: Study Guide, 2014. 14. Gumarov, Zh. Fundamentals of Algorithms and Programming (Problem Book) / Zh. Gumarov. 15. Boribaev, B.B. Programming Technologies: Textbook. – Almaty: LLP RPBK "Dauir". – 352 p. (http://rmebrk.kz/bilim/association/boribaev_programmalau.pdf) (http://rmebrk.kz/bilim/association/boribaev_programmalau.pdf)

EP	6B05301 - Physics
Module title	Electrotechnics
Semester	4
Responsible Instructor	Ubayev Zh.K.
Language of Instruction	Kazakh/Russian
Correlation with the Curriculum	Required component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Lectures – 20 hours, practical classes – 20 hours, SIWT – 20 hours, SIW – 60 hours (lecture, lesson, labworks, project, seminar etc.) / 120 hours
ECTS	4

Required and Recommended Prerequisites for Taking the Module:	Mechanics, Electrcity and magnetism
Module objectives/ intended learning outcomes	Objective: To study the fundamentals of electrotechnics and the principles of electric circuits, current, voltage, resistance, and power. Intended Learning Outcomes: 1. Understand and apply Ohm's law and Kirchhoff's laws. 2. Analyse electric circuits using different methods. 3. Explain the principles of magnetic and electromagnetic phenomena. 4. Conduct experiments and interpret measurements in laboratory work. 5. Apply theoretical knowledge in practical settings and real-world problem-solving.
Content	Topics covered in this module include: - Electric charge and electric field - Current, voltage, resistance - Ohm's law and its application - Series and parallel circuits - Kirchhoff's laws - Magnetic field and inductance - Alternating current (AC) theory - Electrical measurements and safety
Forms of Instruction	Oral
Requirements for Study and Examinations	- Active participation in all types of training - Timely completion and submission of SIWT and SIW tasks - Mastery of theoretical material and laboratory skills - Academic honesty and original work submission - Use of approved textbooks and sources
References	1. Arystanbaev K.E. Fundamentals of electronic and measuring technology: a textbook/Arystanbaev K.E. - Almaty: Epigraph, 2019. - 172 pp. 2. Bird J. Fundamentals and Technologies of Electronics and Electronics: Textbook/District. Mazhenov N.A., Smirnov Yu.M., Smakova N.S. - Almaty, 2014. 3. Bird J. Fundamentals and Technology of Electronics and Electronics. Textbook. Section 2, 2014 4. Electrical engineering: textbook/T.V. Bedych. - Almaty: Epigraph, 2019. - 168 s. 5. Glushchenko, T.I. Theoretical foundations of electrical engineering 2: a textbook. Part 1. Transients in electrical circuits/T. I. Glushchenko, T.V. Bedych. - Almaty: CyberSmith, 2019. - 148 s. 6. Ermaganbetov K. Fundamentals of electrical engineering and electronics. Textbook. 2015 7. Kulmamirov, S.A. Fundamentals of electrical engineering in information systems: training manual/S.A. Kulmamirov, A.T. Tokhmetov, L.A. Tanchenko. - Almaty: TechnoZrudit, 2018. - 136 s. 8. Nurpeisova, S.A. Electrical engineering and electrical equipment of buildings: a textbook/S.A. Nurpeisova. - Almaty: AGUNP, 2018. - 176 s. 9. Tuganbaev I.T., Tazabekov I.I., Saginaeva N.K. Electrical engineering. Almaty: Epigraphic edition, 2016. - 368 p.p. 10. Chirkova L.V. Fundamentals of physical electronics. Tutorial, 2017

EP	6B05301 – Physics
Module title	Optics
Semester	4
Responsible Instructor	Toremurat A.Kh.
Language of Instruction	Kazakh
Correlation with the Curriculum	Required component
Forms of Instruction	CER, MOOC, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 30 hours, practical classes – 15 hours, labs – 15 hours, SIWT – 30 hours, SIW – 90 hours (lecture, lesson, labworks, project, seminar etc.) / 180 hours
ECTS	6
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Molecular physics. Mechanics. Mathematical analysis. School physics course.
Module objectives/intended learning outcomes	Module objective: The goals of studying the discipline are to form theoretical knowledge and practical skills in using optical laws to solve a wide range of problems in various fields of science and technology, as well as to present the physics of optical phenomena as a generalization of observations, practical experience and experiment. Learning outcomes: Analyze and evaluate the prostects of the subject area of physics Know the structure and content of a specific academic discipline of general physics in the logic of ascent from the general to the specific, from the abstract to the concrete Own basic methods and techniques of various types of oral and written communication in state and foreign languages in a dynamically developing multilingual and multicultural world within the competence of a specialist in the field of physics, as well as master the Latin alphabet, academic integrity, anti-corruption culture, economic knowledge, fundamentals entrepreneurship and business, fundamentals of law, fundamentals of ecology and life safety, fundamentals of physiological development.
Content	Light radiation is an electromagnetic wave, so optics refers to one of the branches of the theory of electromagnetic fields. It is known that electromagnetic wave range is very wide, which covers almost the entire wavelength region of from 0 to 10-12 m. Optical same interval in this range occupies a negligible range of wavelengths from 0,4-0,76 microns. This interval is arbitrary, since it is only one area of the electromagnetic spectrum, which creates a visual sensation. Creation of new instruments associated with the properties of electromagnetic waves, greatly expanded the concept of "light" range. The study of light phenomena such as interference, diffraction, polarization, etc. made it possible to use them widely in the practical activity of man. The proposed program gives the necessary minimum of knowledge in the field of optics, which is required in the course of the university.
Forms of Instruction	oral
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

EP	6B05301 – Physics
Module title	Atom Physics
Semester	5

Responsible Instructor	Zhubayev Abzal Kantarbayevich, Ass. Prof.
Language of Instruction	Kazakh
Correlation with the Curriculum	Required component
Forms of Instruction	CER, MOOC, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 15 hours, laboratory classes – 15, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Mechanics, Molecular Physics, Electricity and Magnetism, Optics.
Module objectives/intended learning outcomes	The purpose of studying the discipline is to form students' understanding of the structure of the electronic shells of atoms, the structure of nucleus, the properties of atoms and nuclei, the processes occurring in them. Learning outcomes: 1. Knows physical phenomena, their features, methods of observation and experimental research, basic patterns and their mathematical characteristics, applications in science and technology of atomic and nuclear phenomena. 2. Applies basic methods for determining the properties of atoms, nuclei and fundamental particles. Determines the properties of solids. 3. Analyzes the properties of atoms and fundamental particles, quantum concepts and relativistic ideas when considering the interaction of atomic radiation and radioactive radiations with matter. 4. Performs simple theoretical calculations, solves typical tasks. 5. Evaluates the order of physical quantities.
Content	Thermal radiation and Planck's postulate. Photons – particlelike properties of radiation. Le Broglie's postulate – wavelike properties of particles. Bohr's model of the atom. Schroedinger's theory of quantum mechanics. Solutions of time-independent Schroedinger equations. One-electron atoms. Magnetic dipole moments, spin, and transition rates. The scale of the phenomena of the microworld. General properties of atomic nuclei. Rutherford's experience in scattering alpha particles. Atomic nucleus. Quantum mechanical description of nuclear states. Instability of atomic nuclei. Alpha decay. Beta decay. Gamma radiation of nuclei. Nuclear reactions. Resonant nuclear reactions. Fission of atomic nuclei. The interaction of charged particles with matter. Cosmic rays. Primary cosmic radiation. The transmission of cosmic radiation through the atmosphere. Variations of cosmic rays. Hypothesis of the origin of cosmic rays. Possible mechanisms for accelerating particles of cosmic radiation. Nuclear technology in industry and agriculture. Nuclear power sources. Nuclear rocket engines. Nuclear technology in medicine. Radionuclide diagnostics. Nuclear technology in ecology. The crystal lattice. Defects in the crystal lattice. Thermal, electrical and magnetic properties of solids. Superconductivity. The interaction of radiation with solids.
Forms of Instruction	written
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. Eisberg R., Resnick R. Quantum Physics of Atomic, Molecules, Solids, Nuclei, and Particles. Second edition. (John Wiley&Sons, New-York, Chichester, Brisbane, Toronto, Singapore, 2005). 865 p. 2. Abdulla Zh., Ayazbaev T. Lectures on the physics course. Almaty: Dauir Publ., 2012. 528 p. (in Kazakh)

	3. Huanbay E. Atomic and nuclear physics: a textbook. –Almaty: CyberSmith, 2019. -108 p. (in Kazakh) 4. Serkebaev S.K. Physics of the atom and atomic nucleus: a textbook. –Almaty: TehnoErudit, 2018. -268 p. (in Kazakh) 5. Spabekova R.S. Atomic and nuclear physics: a textbook. – Karaganda: Medet Group, 2015. -170 p. (in Kazakh) 6. Volkenstein V.S. Collection of problems in the course of general physics: a textbook. Almaty: Nur-print, 2012. 450 p. (in Kazakh) 7. Aikeeva A.A. Measurement errors of physical quantities: an educational and methodical manual. –Almaty: SSK, 2018. -100 p.(in Kazakh) 8. Zhubayev A.K. Foundations of nuclear gamma resonance spectroscopy. Aktobe, 2013. – 197 p. (in Kazakh) 9. Martin B. Nuclear physics and elementary particle physics: a textbook. Part 2. – Almaty: Association of Universities of the Republic of Kazakhstan, 2014. – 376 p. (in Kazakh) 10. Morzabayev A. K. Physics of high energies: a manual. - Almaty: Epigraph, 2016. – 120 p. (in Kazakh) 11. Vintaikin B.E. Solid State physics: A textbook. Moscow, MSTU, 2008. 360 p. (in Russian) 12. Baipakbayev T.S., Karsybayev M.Sh. General physics course collection of problems: textbook. - Almaty, Ak Shagyl, 2014 – 248 p. (in Kazakh)

EP	6B05301 - Physics
Module title	Academic Writing
Semester	5
Responsible Instructor	Sagimbayeva Shynar Zhanuzakovna Associate Professor
Language of Instruction	Russian, Kazakh languages
Correlation with the Curriculum	Profile discipline, Required component
Forms of Instruction	CER, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 30 hours, SIWT – 25 hours, SIW – 80 hours (lecture, seminar) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Professional Kazakh language and professional foreign language.
Module objectives/intended learning outcomes	Module objective: To teach students how to prepare the text of research papers in accordance with general academic writing requirements. Learning outcomes: 1. To form students' skills in research work and academic writing, to teach them how to perform physical experiments methodically and competently. 2. To prove and explain the correctness of the results of work in accordance with the standards of the organization in the field of physics, to choose tools for data processing. 3. Knows the basics of conducting research and preparing scientific works, writing a plan for written work, checking and correcting the text version. 4. In his professional activity, he uses academic writing methods in preparing scientific works. Analyzes scientific works and classifies them according to their directions. 5. Prepares written works of scientific research works, writes an abstract, scientific articles. Writes reviews and expert opinions for scientific research works.

Content	During the study of the subject, students acquire the knowledge, skills and abilities in the field of scientific research necessary for the effective writing of works of various categories, taking into account the grammatical, stylistic, genre, punctuation and scientific discourse features of written speech, as well as familiarize themselves with the requirements for writing scientific articles, reports, messages for publication in domestic and international journals, and with the materials of scientific and practical conferences.
Forms of Instruction	oral
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. Dinaeva, B.B. Academic enrollment and tuition. Educational tool. – Almaty: Epigraph, 2017.- http//elib.kz 2. Kvitsinia M.B. Academic book, textbook, Sukhum 2018. – http / /neb.arsu.kz 3. Kuvshinskaya Yu.M. Academic letter from research to text, textbook, 2019. - http//neb.arsu.kz 4. Ospanov E.T. Academic subscription, 2018. – http//neb.arsu.kz 5. Korotkina I. Academic letter, 2011 - http//neb.arsu.kz 6. Isenova F.K. Academic writing and reading. Astana, 2015 - http//neb.arsu.kz 7. Ibraeva A.G., Ippolitova T.V. Academic writing: principles of structure and writing scientific text. -Petropavlovsk: 2015.- http//neb.arsu.kz

EP	6B05301-Physics
Module title	Nuclear Physics
Semester	6
Responsible Instructor	Zhubayev Abzal Kantarbayevich, Ass. Prof.
Language of Instruction	Kazakh
Correlation with the Curriculum	Elective component
Forms of Instruction	CER, MOOC, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes-10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Mechanics, Molecular Physics, Electricity and Magnetism, Optics, Atomic Physics.
Module objectives/intended learning outcomes	The purpose of studying the discipline is to familiarize students with the basic physical phenomena occurring in the subatomic microcosm, with their theoretical understanding and methods of experimental observations. Learning outcomes: 1. Knows and understands the main physical phenomena, their features, methods of observation and expert research. 2. Correctly apply quantum concepts and relativistic ideas when considering the properties of the atomic nucleus and elementary particles, the interaction of nuclear radiation with matter. 3. Able to classify the main methods, laws and their mathematical expression in determining the properties of nuclei and elementary particles. 4. Performs simple theoretical calculations; solves typical problems; performs experimental work and analyzes the results obtained.

	5. Formulates the main tasks of the Department qualitatively and quantitatively, evaluates the order of physical quantities.
Content	Proton, neutron, nucleon, charge of the nucleus, isotope, Isobar, radius of the nucleus, enrichment energy of the nucleus, mass defect, specific enrichment energy, magic nuclei, spin of the nucleus, magnetic moment of the nucleus, nuclear magneton, nuclear magnetic resonance method. Alpha particles, Geiger-Nuttall law, range of particle path, displacement rules in beta decay, continuity of the energy spectrum of beta radiation, neutrinos, antineutrinos, weak interactions. γ-spectrum, internal conversion, photoelectric absorption of γ-radiation (photoelectric effect), Compton scattering, nuclear photoelectric effect, natural width of the energy level, resonant absorption of gamma radiation by nuclei, Mossbauer effect.
Forms of Instruction	written
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. Abdulla Zh., Ayazbaev T. Lectures on the physics course. Almaty: Dauir Publ., 2012. – 528 p. (in Kazakh) 2. Zhubayev A.K. Foundations of nuclear gamma resonance spectroscopy. Aktobe, 2013. – 197 p. (in Kazakh) 3. Martin B. Nuclear physics and elementary particle physics: a textbook. Part 2. / B. Martin. – Almaty: Association of Universities of the Republic of Kazakhstan, 2014. – 376 p. (in Kazakh) 4. Morzabayev A. K. Physics of high energies: a manual / Morzabayev A. K. - Almaty: Epigraph, 2016. – 120 p. (in Kazakh) 5. Serkebayev S.K. Physics of the atom and atomic nucleus: textbook / Serkebayev S. K. - Almaty: Technoerudit, 2018. – 268 p. (in Kazakh)

EP	6B05301-Physics
Module title	Electrodynamics
Semester	5
Responsible Instructor	Ubaev Zhiger Kartbaevich, docent
Language of Instruction	Kazakh
Correlation with the Curriculum	Major discipline, university component
Forms of Instruction	Lectures, laboratory work, SIWT (Instructor-guided self-study), SIW (Student independent work)
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes-10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Mathematical analysis, Electricity and Magnetism
Module objectives/intended learning outcomes	Objective: The purpose of teaching electrodynamics is to understand the theoretical laws of the electrical department. Intended Learning Outcomes: 1. Knowledge of the basic concepts, laws and models of general theoretical physics, competent presentation and interpretation (application) of the result, seeing the applied aspect in solving a scientific problem.

	2. Be able to formulate (know and understand) the main results of fundamental and applied research in the field of physics and mathematics as a theory related to a studied phenomenon or law. 3. Apply mathematical knowledge and methods to solve practical-oriented problems, analyze quantitative data presented in the form of graphs, diagrams, analysis of information of a statistical nature, be able to classify (analyze) the use of mathematical methods in the analysis and synthesis of physical processes, facts and phenomena under control. 4. Organization of educational and research work of students, academic writing, drawing up a plan for methodically competent implementation of a physical experiment (synthesis). 5. ability to evaluate (evaluate) the acquired knowledge in physical and mathematical disciplines for the successful acquisition of knowledge in the disciplines studied in the direction of training.
Content	Topics covered in this module include: - Electrodynamics is a branch of physics that considers and studies the general properties of the electromagnetic field and electromagnetic phenomena from a classical (non-quantum) perspective. Theoretical courses of electrodynamics will help students to thoroughly analyze the phenomena of electromagnetism using mathematical methods. In order for students to better understand the physical laws of electrodynamics, it is not only theoretically studied in the program, but also experimentally explained on the basis of Bloom's taxonomy.
Forms of Instruction	Traditional (written/oral ticket-based exam)
Requirements for Study and Examinations	- Active participation in all types of training - Timely submission of SIWT and SIW tasks - Mastery of theoretical material and lab skills - Academic integrity and individual work submission - Use of approved textbooks and digital tools
References	1. Beisen, N. Electrodynamics: Textbook. – Al-Farabi Kazakh National University. – Almaty: Kazakh University, 2011. – 80 p. 2. Bizhigitov, T. Electrodynamics and the Special Theory of Relativity: Textbook. – Ministry of Education and Science of the Republic of Kazakhstan; Association of Higher Educational Institutions of the Republic of Kazakhstan. – Almaty: LLP RPBK "Era", 2012. – 448 p. 3. Abildayev, A. Physics. Fundamentals of Electrodynamics: Methodological Guidelines. – Almaty: Rauan, 1993. – 96 p. 4. Malishevsky, V.F., Lutsevich, A.A. Fundamentals of Electrodynamics. – [Electronic Resource], 2018. 2. Esengaliyev, E.A. Electrodynamics: Special Theory of Relativity. Theory of the Electromagnetic Field. – [Electronic Resource], 2014.

EP	6B05301-Physics
Module title	Quantum mechanics
Semester	6
Responsible Instructor	Shanina Zamzagul Kuatovna
Language of Instruction	Kazakh/Russian
Correlation with the Curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Total work load: 145 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:	Mathematical analysis, Mechanics, Optics, Atom and atomic nucleus physics
Module objectives/intended learning outcomes	**Learning objective:** Formation of the basic concepts and foundations of relativistic quantum mechanics **The intended learning outcomes are:** 1. Uses mathematical knowledge and methods for solving practical and applied problems, analyzes quantitative data presented in the form of graphs, diagrams, statistical information, applies mathematical methods in the analysis and compilation of physical processes, data and phenomena; 2. Increases the ability to independently identify, understand and evaluate the capabilities of the subject area in physics; 3. Can use basic theoretical knowledge in physics, practical skills and abilities to solve organizational and management problems; 4. Knows the basic laws, fundamental principles and laws of quantum mechanics, their expressions, fundamental concepts and laws; 5. Finds the correct relationship between basic laws and individual specific problems, and uses them to solve problems in quantum mechanics and other branches of science related to quantum mechanics; 6. Formulates and defends problems, summarizes, and performs control work.
Content	The origins of quantum theory. Basic principles of quantum mechanics. Operators of physical quantities. Eigenfunctions and eigenvalues of operators. Schrödinger equation. Simple problems of quantum mechanics. Theory of phenomena. Matrix formulation of quantum mechanics. Quantum theory of angular momentum. Matrices of angular momentum operators. Motion in a centrally symmetric field. Approximate calculation methods of quantum mechanics. Quantum theory of equilibrium particle systems.
Forms of Instruction	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 (SIWT assignments, 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. Imambekov O. Quantum mechanics. Non-relativistic theory: textbook / O. Imambekov. – Almaty: Kazakh University, 2017. – 282 p. ISBN 978-601-04-2110-3 2. Tamaev, S. Collection of problems of quantum mechanics - Almaty: Textbook, 2015. – 299 p. 3. Konishi, K., Paffuti, J. Quantum mechanics. A new approach: Textbook/audio. Sakhiev S.K. Part 1, 2013. 4. Kurenkeyev T.B., Kurenkey B.T. Quantum mechanics (Theoretical physics course) - Almaty: Textbook, 2012. – 318 p. 5. Kozhamkulov T.A., Imambekov O.I. Collection of problems of quantum mechanics. -Almaty: Kazakh University, 2006. 6. Kozhamkulov T.A., Zhusupov M.A., Imambekov O.I. Quantum mechanics. -Almaty: Kazakh University, 2006. 7. Akhmetov A.K. Introduction to quantum mechanics: textbook. – Astana: Foliant, 2004. – 232 p

EP	6B05301-Physics
Module title	Electronics and Circuitry
Semester	5

Responsible Instructor	Ubaev Zhiger Kartbaevich, docent
Language of Instruction	Kazakh
Correlation with the Curriculum	Major discipline, university component
Forms of Instruction	Lectures, laboratory work, , SIW
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 15 hours, laboratory classes – 15, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	General Physics, Electronics
Module objectives/intended learning outcomes	Objective: To provide students with theoretical and practical knowledge in the field of microelectronics, including design principles of analog and digital integrated circuits, semiconductor devices, and fabrication technologies. Intended Learning Outcomes: 1. Explain the operation principles of semiconductor devices used in microelectronics. 2. Analyze the basic analog and digital electronic circuits. 3. Apply design methods for integrated circuits and microelectronic systems. 4. Use modern software tools for modeling and simulation of microelectronic circuits. 5. Evaluate performance parameters of microelectronic devices and systems.
Content	Topics covered in this module include: - Introduction to microelectronics - Semiconductor physics: P-N junction, diodes - Bipolar junction transistors (BJT) - MOSFETs and CMOS technology - Digital logic circuits and CMOS inverters - Layout design and design rules - Analog circuit design and op-amps - Memory devices: SRAM, DRAM - VLSI design and simulation tools - Mixed-signal systems: ADCs/DACs - Final project and presentations
Forms of Instruction	Traditional (written/oral ticket-based exam)
Requirements for Study and Examinations	- Active participation in all types of training - Timely submission of SIWT and SIW tasks - Mastery of theoretical material and lab skills - Academic integrity and individual work submission - Use of approved textbooks and digital tools
References	1. Lachin, V.I., Savyolov, N.S. Electronics: Textbook. – Rostov-on-Don: Phoenix Publishing House, 2020. – 576 p. (Series: Higher Education). InEU Reading Room. 2. Sidnev, Yu.G. Electrical Engineering with Basics of Electronics: Academic Manual. 3rd ed. – Rostov-on-Don: Phoenix, 2022. – 384 p. InEU Reading Room. 3. Information and Measuring Equipment and Electronics / Ed. by G.G. Ranneva. – Moscow: Academia, 2010. – 448 p. 4. Electrical Engineering and Electronics: Illustrated Textbook / Ed. by P.A. Butyrin. – Moscow: Academia, 2018. – 892 p. 5. Poster: Electrical Engineering and Electronics. Illustrated Study Guide / Ed. by P.A. Butyrin. – Moscow: Academia, 2017. – 352 p.

	6. Electrical Engineering and Electronics / Ed. by B.I. Petlenko. – Moscow: Academia, 2017. – 31 p. 7. Alekhin, V.A. Electrical Engineering and Electronics. Computer Laboratory Workshop in the TINA-8 Software Environment: Textbook for Universities / V.A. Alekhin. – Moscow: RiS, 2014. – 208 p. 8. Aliverti, P. Electronics for Beginners: The Easiest Step-by-Step Tutorial / P. Aliverti. – Moscow: Eksmo, 2014. – 160 p. 9. Astapenko, V.A., Movnin, S.M., Protasov, Yu.Yu. Photoelectronics. Part 1. Applied Electronics. – Moscow: Janus-K, 2010. – 654 p. 10. Baranochnikov, M.L. Micromagnetic Electronics. Vol. 2 / M.L. Baranochnikov. – Moscow: DMK, 2014. – 888 p. 11. Barybin, A.A. Electronics and Microelectronics: Physical and Technological Foundations / A.A. Barybin. – Moscow: FIZMATLIT, 2006. – 424 p. 12. Barybin, A.A. Electronics and Microelectronics: Physical and Technological Foundations / A.A. Barybin. – Moscow: FIZMATLIT, 2008. – 424 p.

EP	6B05301-Physics
Module title	Astrophysical Research
Semester	5
Responsible Instructor	Yesimguzhiyeva Gulziya Bisenbaikyzy
Language of Instruction	Kazakh
Correlation with the Curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, laboratory classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes – 10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.)/ 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Astrophysics is a branch of astronomy that aims to study stars using concepts from physics, chemistry, and other sciences.
Module objectives/intended learning outcomes	Learning objective: The objective is to form general knowledge about the structure, motion, and development of celestial bodies, to establish an understanding of the new physical representation of the world through scientific cognition, to know how to apply fundamental laws, classical and modern physics theories, as well as to view physical research methods as a systematic basis for professional creativity. The intended learning outcomes are: 1. Forming an understanding of modern scientific methods in the study of celestial bodies is about comprehending the contemporary technologies and methods used to explore the structure, motion, and development processes of celestial bodies. These methods are developed based on scientific fields such as astronomy, astrophysics, and cosmology, and using them allows for the identification of the properties of celestial objects, the study of their motion laws, and the observation of the evolution of astronomical objects. 2. The ability to apply fundamental laws and the theories of classical and modern physics refers to the student's capability to correctly apply key physical laws as well as the theories of classical and contemporary physics. 3. The ability to classify the components of the new astronomical depiction of the universe in scientific knowledge.

	4. The ability to apply astrophysical research methods in professional creativity, including writing new analytical reports, abstracts, and developing plans. 5. The ability to assess the importance of the structure, motion, and development of celestial bodies. 6. Analysis of the results obtained during laboratory work and checking the validity of the report result, filling in tables and graphing the results of the analysis, processing the results, calculating errors, deducing the percentage of deviations from the theory, summarising the results.
Content	The Astrophysics course includes the following: Astrophysics, Telescopes, Optical Instruments, Key Characteristics of Stars, Spectral Classification of Stars, Mass and Size of Stars, Binary Stars, Physical Variable Stars, History of Our Universe, Three Types of Matter in the Universe, Superstring Theory, Discovery of Dark Energy, Antigravity, Solar Activity and the Biosphere, Multiverse.
Forms of Instruction	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 (SIWT assignments, 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. Zhanabaev Z.Zh. General Astronomy: A Study Guide. - Almaty: Kazakh University, 2016. - 184 p. 2. Kenjeliyev D.I. Fundamentals of Astronomy: A Study Guide / D.I. Kenjeliyev. - Almaty: Evero, 2013. - 258 p. 3. Akilbekov A.T. Physics of Condensed Matter: A Study Guide / A.T. Akilbekov, A.T. Daulbekova, M.V. Zdorovets. - Astana: L.N. Gumilyov ENU, 2013. - 129 p. 4. Zhanabaev Z.Zh. General Astronomy: A Study Guide. - Almaty: Kazakh University, 2016. - 184 p. 5. Kenjeliyev D.I. Fundamentals of Astronomy: A Study Guide / D.I. Kenjeliyev. - Almaty: Evero, 2013. - 258 p. 6. Akilbekov A.T. Physics of Condensed Matter: A Study Guide / A.T. Akilbekov, A.T. Daulbekova, M.V. Zdorovets. - Astana: L.N. Gumilyov ENU, 2013. - 129 p. 7. Torekhojaev A.N., Tugambaeva D.T., Kiryqbaev B.Zh. Theoretical Mechanics. Almaty, 2019. - 502 p. 8. Kurenkeev T.B. Course of Theoretical Physics: Volume 1. Theoretical Mechanics. Textbook. - Almaty: Evero, 2017. - 106 p. 9. Odiak B.P., Nametkulova R.Zh., Kadyrimbetova A.K. Problems and Exercises in General Physics Course (Fundamentals of Classical Mechanics, Molecular Physics, and Thermodynamics) Part 1, 2020. 10. Adyrbekov M.A. Theoretical Mechanics, 2018. - http://elib.kz

EP	6B05301 – PhysicsOP BA 6B05301 – Physics
Module name	CP6305 Condensed Matter Physics
Semester	2 semester
Module Responsible	Aimagambetova G.K., associate professor
Work language	Kazakh languages
Correlation with the curriculum	This module is an essential part of the 7M05301 Physics program. It provides in-depth theoretical and experimental knowledge of the properties and behavior of solids and liquids. The course builds on foundational courses such as quantum mechanics, thermodynamics, and statistical physics.
Teaching methods	Lectures Practical classes Laboratory work Independent student work (ISW/ISWT) Consultations Online learning tools (Platonus platform, university e-library)
Study load / Labor intensity	Lectures: 15 hours Practical classes: 15 hours Laboratory work: 10 hours Instructor-led Independent Study: 30 hours Student Independent Study: 80 hours
Credits/credits	5
Conditions for admission to study within the module	Successful completion of prerequisites: Quantum Mechanics, Statistical Physics, General Physics, Solid State Physics (Intro level)
Module objectives/intended learning outcomes	Upon successful completion of the module, students will be able to: Understand crystal structures and defects in solids Analyze the band theory of solids and the behavior of electrons in metals and semiconductors Describe phonons and lattice vibrations Apply concepts of superconductivity and magnetism Conduct experimental studies on thermal and electrical conductivity Interpret X-ray diffraction and other characterization techniques
Content	1. Crystal structure of solids 2. X-ray diffraction and reciprocal lattice 3. Electronic structure: free electron model and band theory 4. Phonons and lattice heat capacity 5. Magnetic properties of materials 6. Superconductivity: BCS theory basics 7. Defects and dislocations in crystals 8. Experimental techniques: conductivity, thermal analysis, diffraction methods
Exam forms	Oral exam using a ticket-based system with 30 tickets containing three questions per ticket based on Bloom's taxonomy: Level 1: 20 points Level 2: 30 points

	Level 3: 50 points Total: 100 points
Training and exam requirements	Completion of all lab reports Participation in all practical and lecture activities Submission of independent student work Minimum 50 points required during semester to be admitted to final exam
Literature	**Main sources:** 1. Charles Kittel – *Introduction to Solid State Physics* 2. Ashcroft and Mermin – *Solid State Physics* 3. Yu.A. Osipyan – *Physics of Condensed State* 4. R.E. Peierls – *Quantum Theory of Solids* **Online resources:** 1. https://phet.colorado.edu 2. https://nptel.ac.in

EP	6B05301-Physics
Module title	Astronomy (Dual Education)
Semester	5
Responsible Instructor	Yesimguzhiyeva Gulziya Bisenbaikyzy
Language of Instruction	Kazakh
Correlation with the Curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, laboratory classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes – 10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Mechanics, Theoretical Mechanics, Electrodynamics, Introduction to Solid State Physics.
Module objectives/intended learning outcomes	Learning objective: To develop general knowledge about the structure, motion, and evolution of celestial bodies; to form an understanding of the new physical representation of the universe through scientific cognition; to be able to apply fundamental laws, classical and modern physics theories; and to view physical research methods as a systematic foundation for professional creativity. The intended learning outcomes are: 1. The formation of an understanding of modern scientific methods for studying celestial bodies means ensuring that students acquire in-depth knowledge of contemporary scientific approaches and technologies used to study space objects (such as stars, planets, galaxies, nebulae, etc.). 2. The ability to apply fundamental laws, classical, and modern physics theories. 3. The ability to classify the components of the new astronomical representation of scientific understanding of the universe means that

	students acquire modern perspectives in astronomy and cosmology, as well as new concepts and theories related to the structure and developmental laws of the universe. 4. The ability to apply astronomical research methods in professional creative tasks, including writing modern analytical reports, preparing term papers, and developing structured project plans. 5. The ability to assess the significance of the structure, motion, and evolution of celestial bodies. 6. Analysis of the results obtained during laboratory work and checking the validity of the report result, filling in tables and graphing the results of the analysis, processing the results, calculating errors, deducing the percentage of deviations from the theory, summarising the results.
Content	Fundamentals of Spherical and Practical Astronomy, Culmination of Celestial Bodies, Celestial Sphere, Units of Time Measurement, Calendar Systems, Fundamentals of Celestial Mechanics, Physics of the Solar System, Minor Planets: Discovery History, Comets and Their General Types, Meteors and Meteorites, Spectral Classification and Chemical Composition of Stars, Our Galaxy, Structure of the Galaxy, Problems of the Expanding Universe, Hubble's Law
Forms of Instruction	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 (SIWT assignments, 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. Kononovich, P.I., Moroz, E.V. Course in General Astronomy: Textbook. – Moscow: Nauka, 1966. – 528 p. 2. Volynsky, B.A. Astronomy: Textbook. – Moscow: Prosveshchenie, 1971. – 208 p. 3. Getman, V.S. Grandchildren of the Sun: Asteroids, Comets, and Meteoric Bodies. – Moscow: Nauka, 1989. – 176 p. 4. Imazhanova, K.N. Brief Russian–Kazakh Explanatory Dictionary of Astronomical Terms. – Almaty: RBK, 1996. – 108 p. 5. Dagaev, M.M. Laboratory Practicum on General Astronomy: Textbook. – Moscow: Vysshaya Shkola, 1963. – 314 p. 6. Kurishev, V.I. Astronomy Practicum: Textbook. – Moscow: Prosveshchenie, 1986. – 144 p. 7. Levitan, E.P. Astronomy. Grade 11. – Almaty: Mektep, 2001. – 208 p. 8. Kaufmann, W. Planets and Moons / Translated from English; edited by V.V. Shevchenko. – Moscow: Mir, 1982. – 216 p. 9. Popov, P.I., Vorontsov-Velyaminov, B.A., Kunitsky, R.V. Astronomy: Textbook. – Moscow: Prosveshchenie, 1967. – 406 p. 10. Yeremeyeva, A.I., Tsitsin, F.A. History of Astronomy. – Moscow: Moscow State University, 1989. – 349 p.

EP	6B05301-Physics
Module title	Physics of Semiconductors and Dielectrics
Semester	6
Responsible Instructor	Amirbek Zarlykovich Bekeshev
Language of Instruction	Kazakh/Russian
Correlation with the Curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 30 hours, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	General Physics. Condensed Matter Physics. Optics of Semiconductor Nanostructures and Nanotechnologies.
Module objectives/intended learning outcomes	Learning objective: Study of elements that occupy the position between conductors and dielectrics in terms of electrical properties, including composite and intrinsic semiconductors. The intended learning outcomes are: Understands theoretical materials on the formation of EMF (electromotive force) in semiconductors and dielectrics, and knows the features of semiconductor and dielectric physics. Determines its place in the physics of solid-state materials. Is capable of solving problems and conducting laboratory work related to the physical properties of semiconductors. Applies technological methods based on the physical properties of semiconductors and dielectrics, can distinguish materials based on the physical properties of semiconductors and dielectrics. Can differentiate its practical use, synthesizes the differences between semiconductors and dielectrics, and describes semiconductor devices and their applications.
Content	Fundamentals of the band theory of semiconductors. Chemical bonding in semiconductors. Non-crystalline or amorphous semiconductors. Perfect lattice. The separation of quantum states in the bands. Fermi-Dirac distribution theory. Electron and hole concentration in the bands.
Forms of Instruction	Oral Exam (Ticket)
Requirements for Study and Examinations	- obtaining quality knowledge; - fulfil the teacher's requirements specified in the syllabus; - independently complete all types of work (SIWT assignments, 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.Maksanova, L.A. High-Molecular Compounds and Materials Based on Them, Used in the Food Industry. – Moscow: Kolos S, 2015. – 213 p. 2.Kuleznev, V.I., Shershnev, V.A. Chemistry and Physics of Polymers. – Moscow: Kolos S, 2017. – 367 p. 3.Tagger, A.A. Physical Chemistry of Polymers. – Moscow: Nauchny Mir, 2017. – 576 p. 4.Practical Course in Chemistry and Physics of Polymers (edited by V.F. Kurenkov). – Moscow: Khimiya, 2015. 5.Semchikov, Yu.D. High-Molecular Compounds. – Moscow: Akademiya, 2015. 6.Polymer Composite Materials: Structure, Properties, Technology (textbook edited by A.A. Berlin). – Saint Petersburg: Professiya, 2014. – 591 p.

	7.Mikhaylin, Yu.A. Fiber Reinforced Polymer Composite Materials in Engineering. – Saint Petersburg: NOT, 2013. – 715 p.

EP	6B05301-Physics
Module title	Nanotechnology
Semester	6
Responsible Instructor	Zhubayev Abzal Kantarbayevich, Ass. Prof.
Language of Instruction	Kazakh
Correlation with the Curriculum	University component
Forms of Instruction	CER, MOOC, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes-10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Mechanics, Molecular Physics, Electricity and Magnetism, Optics, Atomic Physics, Nuclear Physics, Mathematical analysis.
Module objectives/intended learning outcomes	The purpose of studying the discipline is to form students' understanding of the methods, laws and models of modern nanotechnology. Learning outcomes: 1. Knows and understands the basic principles and laws of physical phenomena and their mathematical characteristics, various observations of electromagnetism and quantum physics in various fields of physics and natural sciences, computer methods of processing experimental data. 2. Correctly applies the basic methods of observation and experimental research of physical phenomena, methods of accurate measurements of physical quantities, basic physical instruments and methods of automation of physical experiment. 3. Classifies nanomaterials. 4. Creates mathematical models of elementary physical phenomena. 5. Evaluates the use of elements of mathematical methods and scientific research in applied problems and the possibilities of applying the results obtained.
Content	Quantization of energy. Particle-wave dualism. Atom, molecule, nanocrystal, single crystal. The band theory of solid. A potential barrier, its height. Tunnel effect. Classification of nanomaterials. Technologies for the production of nanomaterials. Devices used in nanotechnology. Clusters and combinations of their properties. Methods for obtaining clusters, magic numbers. Quantum dots. Carbon-based structures. Production of carbon nanostructures. Mechanical properties of carbon nanostructures. Chemical properties of carbon nanostructures. Electrical properties of carbon nanostructures. The use of carbon nanotubes. Optical superlattices. Diffraction on a one-dimensional, two-dimensional, three-dimensional superlattice. Zone theory. Optoelectronics. Production of photonic crystals. The use of photonic crystals. Photonic crystals in nature. A single-electron transistor. A resonant tunnel diode. Nanocomputers. Quantum optoelectronics. LEDs. Lasers. Elements of microelectromechanical systems. Membrane power elements. MEMS power elements based on carbon nanotubes. Nanocoating. Catalysts and filters. Nanotechnology in medicine. Nanotechnology in perfumery and industry. Nanotechnology used in the manufacture of sporting goods. Clothes and shoes. Nanotechnology in the military.
Forms of Instruction	written

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. Encyclopedia of Nanotechnology. Second Edition. Ed. B. Bhushan. (Springer Science+Business Media Dordrecht, 2016). 4427 p. 2. Foundations of Nanotechnology. Volume 3. Mechanics of Carbon Nanotūbes. Ed. S. Rafiei. (Apple Academic Press, 2015) 268 p. 3. Nanotechnology in Biology and Medicine. Methods, Devices, and Applications. Second Edition. Ed. T. Vo-Dinh. (Taylor&Francis Group, 2018). 739 p. 4. Springer Handbook of Nanotechnology. 4th edition. Ed. B. Bhushan. (Springer-Verlag GmbH Germany 2017) 1700 p. 5. Zhubayev A.K., Nurtazina A.S. Introduction to Nanotechnology: a manual. - Aktobe, Litera-A, 2014. - 178 p. 6. Zhubayev A.K., Nurtazina A.S. Methodical manual for laboratory classes for 3rd year students of specialty «5B060400 – Physics» on the discipline «Introduction to nanotechnology». - Aktobe, 2015. - 60 p.

EP	6B05301-Physics
Module title	Physical Materials Science
Semester	7
Responsible Instructor	Amirbek Zarlykovich Bekeshev
Language of Instruction	Kazakh/Russian
Correlation with the Curriculum	Basic discipline, university component
Forms of Instruction	Lecture, practical classes, SIWT, SIW.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 15 hours, SIWT – 15 hours, SIW– 45 hours (lecture, lesson, laboratory work, project, seminar, etc.) / 90 hours
ECTS	3
Required and Recommended Prerequisites for Taking the Module:	General Chemistry courses, Mechanics, Molecular Physics, and Electricity and Magnetism.
Module objectives/intended learning outcomes	Learning objective: to understand the structure of engineering materials in accordance with their physical and mechanical properties and the regularities of their formation; to acquire knowledge on the proper selection of materials with the required properties and their heat treatment. The course also aims to deepen students' understanding of the composition, structure, and properties of structural materials, methods for improving them, as well as the use of modern research methods and instruments. The content of this course reflects the current level of technical and technological development. The intended learning outcomes are: - Understand the technology of manufacturing construction and electrical engineering materials, taking into account their individual properties and processing characteristics, as well as their applications in instrument-making; -Gain a clear understanding of the directions for improving existing materials and developing new electrical engineering devices and materials; -Know the basic properties and practical applications of widely used conductive, semiconductive, insulating, and magnetic materials, along with the technologies for processing them;

	-Select appropriate types and grades of electrical engineering materials based on their electrical and magnetic parameters and their dependence on environmental conditions; -Apply proper methods for using electrical engineering devices and selecting gaseous, solid dielectrics, and fillers; -Acquire practical skills in performing measurements, calculating predicted properties under real conditions, and organizing testing of various materials.
Content	Electrical properties of materials. Optical properties of materials. Magnetic properties of materials. Thermal properties of materials. Mechanical properties of materials. The influence of chemical bonds on atomic and ionic radii. Fundamental issues of phase equilibrium thermodynamics. Phase rule and Gibbs' law.
Forms of Instruction	Oral Exam (Ticket)
Requirements for Study and Examinations	- obtaining quality knowledge; - fulfil the teacher's requirements specified in the syllabus; - independently complete all types of work (SIWT assignments, 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. Ismailova, G.A., Prikhodko, O.Yu., Tashkeeva, G.K. Introduction to Physical Materials Science: Textbook. – Almaty: Kazakh University, 2014. 2. Zhanturina, N.N. Physics of Condensed Matter: Textbook. – Aktobe: K. Zhubanov Aktobe Regional State University Publishing Office, 2017. 3. Callister, William D., Jr., Rethwisch, David G. Materials Science and Engineering. – Wiley, 2017. 4. Materials Science and Metal Technology: Textbook / General Editor R. Gschweidl, translated from German. – Astana: Foliant, 2019. 5. Mashekov, S.Ä. Materials Science and Technology of Structural Materials: Textbook. – Almaty: Al'manakh, 2017.

EP	6B05301-Physics
Module title	Nuclear Gamma Resonance
Semester	7
Responsible Instructor	Zhubayev Abzal Kantarbayevich, Ass. Prof.
Language of Instruction	Kazakh
Correlation with the Curriculum	Elective component
Forms of Instruction	CER, MOOC, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes-10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.)/ 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Molecular Physics, Electricity and Magnetism, Optics, Atomic Physics, Physics of Solid, Mathematical Analysis.
Module objectives/intended learning outcomes	The purpose of the discipline is to explain the methods, laws, models and basic laws of modern spectroscopy, to develop students ' physical thinking. Learning outcomes: 1.knows and understands effect-based transformations, advantages and disadvantages of spectroscopy, factors affecting the change in The Shape of the resonant line of the spectrum.

	2.use the basic concepts of effects and methods of spectroscopy, methods of experimental Efficiency, software for processing Spectra. 3.classifies ways to improve the performance of the spectrometer and determine the effective thickness of the sample for research. 4.forms mathematical models of Spectra based on processing methods. 5.evaluates the use of mathematical methods and elements of scientific research in Applied Problems and the applicability of the results obtained.
Content	The significance of the effect of resonant absorption of gamma quanta. The atomic nucleus. Nuclear energy transition. The shape of the emission and absorption lines. The energy of recoil. Doppler line broadening. The Mossbauer effect and its probability. The general scheme of nuclear transitions. The main characteristics of Mossbauer isotopes. The basics of the Mossbauer experiment. The scheme of the experiment. The Mossbauer spectrometer. The Mossbauer spectrum and the longitudinal Doppler effect. The Poisson distribution. The envelope of the spectrum. The magnitude of the effect. The effective thickness of the sample. The shape of the emission line, absorption line, and resonance line. Absorption of gamma quanta in the source. Geometric effect. The quality of the spectrum. Ways to optimize the experiment. Saturation effect. Hyperfine interactions. Electrical monopolistic interaction. The energy of electrostatic interaction. Electrical monopole interaction and displacement of the Mossbauer line. Description of the electronic configuration of the atom. A hydrogen-like atom. A multi-electron atom. One-electron approximation. Covalence effects. Electrical quadrupole interaction and quadrupole displacement of spectrum components. Properties of the gradient tensors of the quadrupole moment and electric field. The Hamiltonian of the quadrupole displacement. The intensity of transitions. The gradient of the electric field (GEP). Screening effects. The gradient of the electric field of localized charges of surrounding ions. The gradient of the electric field of the valence electrons of the Mossbauer atom. GEP of conduction electrons. Magnetic dipole interaction. Magnetic dipole interaction and the Mossbauer spectrum. The magnetic moment of the core. The Hamiltonian of magnetic interaction and the hyperfine structure of levels. The intensity of transitions. Effective magnetic field on the core. Fermi's contribution. The orbital contribution. The spin contribution. The contribution of conduction electrons. Macroscopic contributions. Combined hyperfine interaction.
Forms of Instruction	written
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. Encyclopedia of Spectroscopy and Spectrometry. 2nd edition. Ed. J.C. Lindon, G.E. Tranter, D.W. Koppenaal. (Academic Press, Oxford, UK, 2010). 3233p. 2. Gutlich Ph., Bill E., Trautwein A.X. Mossbauer Spectroscopy and Transition Metal Chemistry: Fundamentals and Applications. (Springer-Verlag Berlin Heidelberg 2011) 568 p. 3. Zhubayev A.K. Foundations of nuclear gamma resonance spectroscopy. Aktobe, 2013. – 197 p. (in Kazakh) 4. Mössbauer Spectroscopy: Tutorial Book. Ed. Yu.Yoshida, G.Langouche. (Springer-Verlag Berlin Heidelberg, 2013). 308 p. 5. The RudolfMössbauer Story. His Scientific Work and Its Impact on Science and History. Ed. M.Kalvius,P.Kienle. (Springer-Verlag Berlin Heidelberg, 2012). 433 p.

EP	6B05301-Physics
Module title	Information and mechanical technology
Semester	7
Responsible Instructor	Serikbayeva Gulbanu Duisenkyzy
Language of Instruction	Kazakh
Correlation with the Curriculum	Elective component
Forms of Instruction	CER, MOOC, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes-10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.)/ 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Electricity and Magnetism, Electrical Engineering
Module objectives/intended learning outcomes	Module objectives: The purpose of the subject “Information and Measuring Technology” is the training of specialists in the specialty “Physics” for technical and competent operation and maintenance of electrical devices and complexes on their basis, as well as general scientific and technical training. learning outcomes: Understands the physical processes occurring in measuring circuits; Knows about measurements, methods and means of measurement, error theory and methods of processing measurement results; Understands how to make fast and highly accurate measurements with the optimum number of instruments in a given situation; Knows how to use virtual instruments and computerized measurement systems; Develops implementation of skilled use of tools, equipment, and automated systems; Uses specialized scientific, methodological, reference references and knows how to use system and application software
Content	General characterization of measurement methods and measuring instruments. Errors of electrical measurements. Metrological characteristics of analog measuring instruments. Measuring mechanisms of analog devices. Measurement of direct current and voltage in production conditions. Measurement of alternating currents and voltages. Digital instruments. Measurement of electrical resistance. Measurement of frequency and time parameters of voltage and current. Measurement generators.
Forms of Instruction	Oral (ticket)
Requirements for Study and Examinations	- obtaining quality knowledge; - fulfill the requirements of the teacher, as specified in the syllabus; - independently complete all types of work (SIWT assignments, term papers, graduation theses, etc.) and submit them to the teacher on time; - use reliable and trustworthy sources of information; - do not submit your work to be cheated by other students. - The examination will be administered in accordance with the University's academic integrity policy and examination regulations. - If plagiarism or copying is detected, the exam results will be automatically invalidated and the course will be retaken in the summer semester.
References	Main References: 1. Avilova, Natalia Vasilievna Details, mechanisms and design of measuring devices. Textbook for course design: monograph / Avilova Natalia Vasilievna. - Moscow: Don State Technical University (DSTU), 2017.- 856p

	2. Ageev, V. I. Instrumentation of ship power plants (device, operation, efficiency). Reference book / V.I. Ageev. - Moscow: Sudostroenie, 2020. - 416 p. 3. English-Russian Dictionary of Automation and Control and Measuring Devices. - Moscow: Gostekhizdat, 2017. – 380 p. 4. English-Russian dictionary of automation, cybernetics and control and measuring instruments. - Moscow: SovetskayaEncyclopedia, 2020.-428 p. 5. Bogner, R. Introduction to digital filtering / R. Bogner, A. Konstantinidis. - 2021. - 335 p. 6. Vazhdaev, Konstantin Vladimirovich; Khabibullin Marat Ilgizovich Microprocessors, Digital Devices and Circuitry of Household Machines and Appliances / Ilgizovich Vazhdaev Konstantin Vladimirovich ;KhabibullinMarat.-Moscow: IL, 2019.- 111 p.

EP	6B05301 – Physics
Module title	Spectroscopic Methods in Solid-State Research
Semester	7
Responsible Instructor	Sagimbayeva Shynar Zhanuzakovna Associate Professor
Language of Instruction	Kazakh languages
Correlation with the Curriculum	Required component
Forms of Instruction	PBL
Academic Workload (including Contact Hours and SIW)	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: Optics, condensed matter physics, solid state physics.
Module objectives/intended learning outcomes	Module objective: The purpose of the subject is to provide a general understanding of the properties and structure of solid crystalline substances. The most common and practically important crystallographic methods are described (crystal optics, X-ray diffraction, etc.). Learning outcomes: 1. Ability to prove and explain the correctness of the results of work in accordance with the standards of the organization in the field of physics, the ability to choose instruments for data processing; Ability of students to organize educational and research work, academic writing, and methodically perform physical experiments; 2. Knowledge of the basic methods of purification and growth of pure alkaline crystals based on the crystal structure of solids; understanding of experimental spectroscopic methods used in the field of materials science, radiation physics, condensed matter physics, and low-temperature physics; 3. Use physical instruments, work with experimental setups; use reference books and references during work, find and work with other necessary sources of information; 4. Conduct research, analysis, and analysis of spectroscopic methods; 5. Must have the skills to use experimental equipment, analyze and evaluate results; Evaluate spectroscopic methods in the study of solids.
Content	The purpose of the subject "Spectroscopic methods in the study of solids" is to describe the mechanisms of the formation of radiation defects and spectroscopic methods based on the study of the luminescence of alkali halide crystals. To describe the physical principles of the experimental setup that automatically records the absorption spectrum, X-ray, photo, tunneling and thermostimulated luminescence in a wide range of spectra and temperatures, as well as ionic conduction currents and thermostimulated depolarization of alkali halide crystals under the influence of uniaxial elastic and plastic deformation.
Forms of Instruction	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. Sagimbayeva, Sh.Zh. Technology for Controlling the Mechanism of Energy Transformation of Ionizing Radiation in Alkali-Halide Scintillator Crystals: Monograph. – Aktobe, 2017. – 120 p. 2. Barmina, A.A. Luminescence and Radiation Defect Formation in Alkali-Halide Scintillator Crystals under Reduced Lattice Symmetry: Monograph. – Aktobe, 2017. – 136 p.

	3. Shunkeyev, K.Sh., Grinberg, M., Szczodrowski, Mahlik, S., Zhanturina, N.N., Myasnikova, L.N., Barmina, A.A., Sagimbayeva, Sh.Zh. Proceedings on the Development of Technology for Controlling the Optical Properties of Oxides, Fluorides, and Alkali-Halide Crystals under Reduced Lattice Symmetry. – Aktobe, 2017. – 112 p. 4. Myasnikova, L.N. Luminescence and Exciton–Phonon Interaction in Alkali-Halide Crystals under Low-Temperature Deformation: Monograph. – Aktobe, 2016. – 140 p. ISBN 978-9965-884-44-3. 5. Zhubayev, A.K. Fundamentals of Nuclear Gamma Resonance Spectroscopy: Textbook. – Aktobe, 2013. – 197 p.

EP	6B05301 – Physics
Module title	Polymer Physics
Semester	7
Responsible Instructor	Senior Lecturer Akhmetova Marzhan
Language of Instruction	Kazakh languages
Correlation with the Curriculum	The discipline "Polymer Physics" is a core course included in the module "Applied Physics Methods" of the educational program 6B05301 – Physics. It is taught in the 7th semester of the 4th year of study. The course is directly aligned with the learning outcomes of the program, ensuring students acquire competencies in applied polymer science, thermophysical and mechanical analysis, and experimental skills relevant to modern material science and industry needs.
Forms of Instruction	Lectures with multimedia support Practical sessions using problem-solving and case-based learning Laboratory work involving hands-on experiments Self-study and individual assignments Group discussions and collaborative tasks
Academic Workload (including Contact Hours and SIW)	Total: 6 credits / 180 academic hours Lectures: 30 hours Practical sessions: 15 hours Laboratory sessions: 15 hours Independent work (SIW/SIWT): 120 hours (30 + 90)
ECTS	6
Required and Recommended Prerequisites for Taking the Module:	Successful completion of the general physics and general chemistry courses is required. Students must possess basic knowledge in thermodynamics, molecular physics, and chemical bonding.
Module objectives/intended learning outcomes	The module aims to develop the student's understanding of high-molecular-weight compounds and their physical behavior. Upon completion, students will be able to: - Describe the structure and physical properties of polymers; - Analyze types of polymeric materials used in various industries; - Operate modern equipment for analyzing polymer properties; - Work with technical databases and determine optimal processing parameters; - Apply standard testing methods to assess composite materials and products.
Content	The course consists of six modules: 9. Structure of Polymers 10. Flexibility of Polymers 11. Phase States of Polymers

	12. Relaxation Phenomena 13. Strength of Polymers 14. Polymer Solutions Topics include polymer classification, molecular weight distribution, elasticity, thermomechanical behavior, relaxation processes, glass transition, mechanical strength, adhesion, solubility, and plasticization.
Forms of Instruction	Oral exam using a ticket-based system with 30 tickets containing three questions per ticket based on Bloom's taxonomy: Level 1: 20 points Level 2: 30 points Level 3: 50 points Total: 100 points
Requirements for Study and Examinations	Students must actively participate in all types of sessions and complete assignments on time. A minimum of 50 points in the semester rating is required to be admitted to the final exam. Academic integrity must be upheld. Plagiarism results in annulment of results and retake of the course in the summer semester.
References	Main references: 1. Kuzina N.G. et al., *Chemistry and Physics of Polymers*, SPbGTI(TU), 2019 2. Tager A.A., *Physical Chemistry of Polymers*, Nauchny Mir, 2017 3. Semchikov Yu.D., *High-Molecular Compounds*, Akademiya, 2016 4. Lavrov N.A., *Polymers Based on N-Vinylsuccinimide*, Profesiya, 2021 5. Online resources and simulations: https://phet.colorado.edu, https://openedu.ru, http://imc.macro.ru , http://polly.phys.msu.ru , http://nanospheres.ru

EP	6B05301 – Physics
Module title	Solving Physical Problems Using Computers
Semester	7
Responsible Instructor	Akhmetova M.K., Master of Pedagogical Sciences in Physics, Senior Lecturer.
Language of Instruction	Russian, Kazakh languages
Correlation with the Curriculum	Required component
Forms of Instruction	Lecture-based teaching, Problem-solving sessions, Case studies, Collaborative learning, Blended learning, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 15 hours, labworks – 15 hours, SIWT – 25 hours, SIW – 80 hours / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Fundamentals of Informatics: understanding programming languages and the ability to use computer applications; Fundamentals of Mathematics: basic knowledge of mathematical analysis and differential equations; Fundamentals of Physics: basic knowledge of mechanics, thermodynamics, and electromagnetic phenomena.
Module objectives/intended learning outcomes	Module objective: The main objective of the course is to teach students how to solve physical problems using computer models and algorithms. In this course, students will learn to model physical phenomena, apply computational methods, develop programming skills, and enhance their ability to analyze solutions. In addition, students will gain an understanding of the role of modern computer technologies in solving physical problems and

	will learn to make creative decisions. Learning outcomes: Understand and apply methods of computer modeling of physical phenomena; Develop the ability to use computer programs and algorithms for solving physical problems; Write programs for physical problems using programming languages; Analyze computational results and present them using graphs and diagrams; Master mathematical modeling of physical processes and methods for computing them using a computer; Analyze solutions and apply them effectively.
Content	The course "Solving Physical Problems Using Computers" focuses on the application of computational methods and computer modeling in solving physical problems. It enables students to translate physical phenomena into mathematical models and find effective solutions through computer programs. The course is aimed at exploring physical laws through algorithms, programming, and numerical methods. Students will use computer tools to solve physical problems and master both analytical and numerical techniques.
Forms of Instruction	Oral exam
Requirements for Study and Examinations	Students who have successfully mastered the course material and achieved at least 50% of the total score from the 1st and 2nd midterm assessments are eligible to take the final exam.
References	Main References / Materials V.I. Klein, V.V. Petrov – Fundamentals of Radio Engineering P.B. Zbar, A. Davis, L. Murray – Fundamentals of Radio Electronics V.V. Kuleshov – Radio Engineering Systems V.M. Karpov – Fundamentals of Radio Engineering and Radio Systems V.V. Popov, K.N. Samoylov – Radio Electronics: Circuitry and Devices Additional References: N.V. Voitovich – Fundamentals of the Theory of Radio Engineering Circuits G. Schill, G. Zelle – Radio Electronics for Beginners A.A. Reyzin – Radio Engineering Systems: Antennas and Radio Wave Propagation L.M. Matveev – Electromagnetic Fields and Waves in Radio Engineering

EP	6B05301-Physics
Module title	Robotics and Mechatronics
Semester	7
Responsible Instructor	Zhubayev Abzal Kantarbayevich, Ass. Prof.
Language of Instruction	Kazakh
Correlation with the Curriculum	Elective component
Forms of Instruction	CER, MOOC, etc.
Academic Workload (including Contact Hours and SIW)	Lectures – 15 hours, practical classes – 20 hours, laboratory classes-10, SIWT – 25 hours, SIW– 80 hours (lecture, lesson, laboratory work, project, seminar, etc.).) / 150 hours
ECTS	5
Required and Recommended Prerequisites for Taking the Module:	Prerequisites: Mechanics, Information and communication technologies, Algebra and geometry, Mathematical analysis, Molecular physics and thermodynamics, Electricity and magnetism, Optics, Atomic physics.

Module objectives/intended learning outcomes	The purpose of the discipline is to explain the methods, laws, models and basic laws of modern robotics and mechatronics, to develop students ' physical thinking. Learning outcomes: 1. Knows and understands thebasic stages of the development of robotics; features of the mechanical component of mobile robot designs; principles of operation and operation of the control unit and electromechanical drives; functions and principles of operation of sensors in mobile robots, the basic principles of programming mobile robots. 2. Uses the control unit and electromechanical drives, sensors in mobile robots, programming of mobile robots. 3. Classifies electromechanical drives of robotics. 4. Design of mobile robots; forms mathematical models of programming the movement of mobile robots. 5. Evaluates the effectiveness of developed designs, algorithms and programs.
Content	The history of the development of robotics. Development of pre-robotics techniques. The emergence and development of modern robotics. Development of robotics in the CIS countries. Mechanical processes in robotics. Electrical processes in robotics. Magnetic processes in robotics. Optical processes in robotics. Human movement management. Construction of robots. Robot drives. Robot control systems. Dynamics of robots. Robotics systems design. Class division of technological complexes in which robots are used. The use of industrial robots in auxiliary operations.
Forms of Instruction	Written
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. Advanced Mechanics in Robotic Systems. Ed. Nestor Eduardo Nava Rodríguez. Springer-Verlag London Limited 2011. 105 p. 2. Artificial Intelligence and Robotics. Eds. Huimin Lu and·Xing Xu. Springer International Publishing AG 2018. 326 p. 3. Dynamic Decoupling of Robot Manipulators. Ed. Vigen Arakelian. Springer International Publishing AG 2018. 118 p. 4. Handbook of Fundamentals and Challenges Collective Robotics. Ed. Serge Kernbach. Taylor & Francis Group, LLC, 2013. 914 p. 5. Humanoid Robotics: A Reference. Eds. Ambarish Goswami and Prahlad Vadakkepat. Springer Nature B.V. 2019. 2699 p. 6. Merzouki R., Samantaray A.K., Pathak P.M., Bouamama B.O., Intelligent Mechatronic Systems: Modeling, Control and Diagnosis. Springer-Verlag London 2013. 943 p. 7. Siegwart R., Nourbakhsh I.R., and Scaramuzza D. Introduction to Autonomous Mobile Robots. Massachusetts Institute of Technology 2011. 453 p. 8. Machine Vision and Mechatronics in Practice. Eds. John Billingsley and Peter Brett. Springer-Verlag Berlin Heidelberg 2015. 350 p. 9. Rovira Más F., Zhang Q. and Hansen A.C., Mechatronics and Intelligent Systems for Off-road Vehicles. Springer-Verlag London Limited 2010. 277 p. 10. Bishop O. The desktop book of a robot developer. Moscow: MK–Press, St. Petersburg: KORONA-VEK, 2010. 400 p. (in Russian)