NCJSC «L.N. GUMILYOV EURASIAN NATIONAL UNIVERSITY»

Module Handbook
Educational program
6B05305 Nuclear Physics

Astana
2022

Module 1

Module code and name	ENGL 11103 Foreign language
Semester(s), when the module is taught	1, 2
Responsible for module person	Ustelimova N.A.
Language of study	English
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Group work. Problematic discussion. search method. Design. Essay. situational modeling. Text analysis. Creative writing.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours - 1 sem., (300 hours per year). Practical: 45 hours -1 sem, (90 hours per year), independent work of students: 105 hours (210 hours per year).
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	To master this module, there is a need of the knowledge, skills and abilities acquired in the course of studying the following courses: Foreign language I (English) minimum sufficient level (A1, common European competence).
Module objectives/intended learning outcomes	The purpose of the module is the formation of intercultural and communicative competence of students of non-linguistic specialties in the process of foreign language education at a sufficient level (A2) of the OEK / at the level of basic sufficiency (B1) of the OEK. Expected learning outcomes: - reveals the patterns of development of a foreign language, paying attention to the study of stylistic originality; - compares and selects the forms and types of speech / communication that correspond to the communicative intention with a logical construction adequate to the type of speech and adequately expresses their own communicative intentions with the correct selection and appropriate use of the necessary language means, taking into account their compliance with the socio-cultural norms of the language being studied; - owns the strategy and tactics of constructing a written communicative act, correctly forms speech in writing, based on lexical sufficiency within the framework of speech topics and grammatical correctness; - systematizes the conceptual foundations for understanding the partner's communicative intentions at this level; - owns the techniques of linguistic description and analysis of the causes and consequences of events in scientific and social texts;
Content	Social sphere of communication: Family in modern society. Socio-cultural sphere of communication: Entertainment. Socio-cultural sphere of communication. Self care. Sociocultural sphere of communication: cultural and historical background. Sociocultural sphere of communication: cultural and historical background. Socio-cultural sphere of communication: Cultural and historical background / Personal, private life. Sociocultural sphere of communication. Culture. Educational communicative sphere/World. Educational communication sphere. Student life. Sociocultural sphere of communication: Cultural and historical background. Education. Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty).
Examination forms	Combined exam: listening, reading, speaking.
Study and examination requirements	Students are required to attend practical classes in a foreign language and take an active part in the implementation of INDEPENDENT WORK OF STUDENTS tasks, the results of which are accepted by the teacher online or in the classroom of the university, depending on the type and form of the task.
Technical, multimedia tools and software	Presentation projector. Edpuzzle, Kahoot, Socrative, Edmodo.

Reading list	1. Latham-Koenig. English File: Pre-Intermediate Student's Book, 3d ed., Oxford University Press, 2016. 2. Latham-Koenig. English File: Intermediate Student's Book, 3d ed., Oxford University Press, 2016. 3. Latham-Koenig. English File: Pre Intermediate Student's Book, 3d ed., Oxford University Press, 2016. 4. Reading Extra: A resource book of multi-level skills activities / Driscoll Liz. - 9th printing. - Cambridge [etc.]: Cambridge university press, 2017. 5. Speaking extra: a resource book of multi-level skills activities / Gammidge Mick. - 13th print. - Cambridge: Cambridge university press, 2017. 6. Listening Extra: A resource book of multi-level skills activities / Craven Miles. - 10th printing. - Cambridge [etc.]: Cambridge university press, 2016. 7. Writing extra: a resource book of multi-level skills activities / Palmer Graham. - 11th print. - Cambridge: Cambridge university press, 2016.

Module 2

Module code and name	KAZK 11104 Kazakh language
Semester(s), when the module is taught	1,2
Responsible for module person	Kulmanov K.S.
Language of study	Kazakh
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Group work. Problematic discussion. search method. Design. Essay. situational modeling. Text analysis. Creative writing.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours - 1 sem., (300 hours per year). Practical: 45 hours -1 sem, (90 hours per year), independent work of students: 105 hours (210 hours per year).
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	To master this module, you need the knowledge, skills and abilities acquired by the student in the course "Kazakh language" (A1, A2, B1).
Module objectives/intended learning outcomes	To train students in listening (listening), speaking, reading and writing at level B2. Participate in communication in various situations in different areas of communication in order to realize their own intentions and needs (household, educational, social, cultural), declaring them ethically correct, meaningfully complete, lexico-grammatically and pragmatically adequate to the situation at level B2; To carry out the correct choice and use of language and speech means for solving certain problems of communication and cognition based on knowledge of a sufficient amount of vocabulary, a system of grammatical knowledge, pragmatic means of expressing intentions at level B2.
Content	Introduction to the course. Kazakhstan on the way to independence: stages of formation of the idea of a national state. Civil-political confrontation. Implementation of the Soviet model of state building. Contradictions and consequences of Soviet reforms in Kazakhstan in the second half of the twentieth century. Formation of the state structure of the Republic of Kazakhstan. Kazakhstani model of economic development. Social modernization is the basis for the well-being of society. Ethno-demographic processes and strengthening of interethnic harmony. Prospects for socio-political development and spiritual modernization. The policy of forming a new historical consciousness and worldview of the peoples of the Great Steppe. Kazakhstan is a state recognized by the modern world. Formation of a nation of a single future.
Examination forms	Combined exam: listening, reading, speaking.
Study and examination requirements	Interactive whiteboard, projector, electronic textbook, computer, assignments for practical exercises, specialty texts, additional handouts.
Technical, multimedia tools and software	Presentation projector.
Reading list	1. Asanova U.O., Abduova B.S., Adilbek A.M., Magzumbekova A.Q. Qazaq tili. B1 dengejine arnalgan oku quraly). Nur-Sultan: EUU, 2021. – 150 bet. 2. Alimbek G.R. Orystildilerge arnalgan Qazaq tili (B1, B2 orta dengejine arnalgan oqu quraly). Nur-Sultan: «AIIDA baspasy PUBLISHING», 2021. -232 bet. 3. Qulmanov Q.S., Adilbek A.M., Magzumbekova A.Q., Hamitova A.G. Qazaq tili (A1 dengeji. Sheteldik studentterge arnalgan oqu quraly). Nur-Sultan: L.N.Gumilev at. EUU, 2021. – 176 bet.

Module 3

Module code and name	RUSS 11104 Russian language
Semester(s), when the module is taught	1,2
Responsible for module person	Nurgazina A.B.
Language of study	Russian
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Group work. Problematic discussion. search method. Design. Essay. situational modeling. Text analysis. Creative writing.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours - 1 sem., (300 hours per year). Practical: 45 hours -1 sem, (90 hours per year), independent work of students: 105 hours (210 hours per year).
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	To master this module, you need the knowledge, skills and abilities acquired by the student in the Russian language course (A1, A2, B1).
Module objectives/intended learning outcomes	To train students in listening (listening), speaking, reading and writing at level B2. Participate in communication in various situations in different areas of communication in order to realize their own intentions and needs (household, educational, social, cultural), declaring them ethically correct, meaningfully complete, lexico-grammatically and pragmatically adequate to the situation at level B2; To carry out the correct choice and use of language and speech means for solving certain problems of communication and cognition based on knowledge of a sufficient amount of vocabulary, a system of grammatical knowledge, pragmatic means of expressing intentions at level B2.
Content	Actual problems of modern science. New discoveries of scientists: prospects for use and possible risks. Scientific discoveries and ethics. Achievements in the field of the studied science. The development of science (studied by students). The current state of the studied science. My specialty and globalization. Written business communication. Business email correspondence. Oral business communication. Terminology of science. Specialty language. Written academic text. Culture of professional speech. Types of professional communicative situations.
Examination forms	Combined exam: listening, reading, speaking.
Study and examination requirements	Interactive whiteboard, projector, electronic textbook, computer, assignments for practical exercises, specialty texts, additional handouts.
Technical, multimedia tools and software	Presentation projector. Reference and information Internet portal - www.gramma.ru Reference and information Internet portal - www.dic. academic.ru Reference and information Internet portal - www.slovari.yandex.ru
Reading list	1.Orys tılı: universitetterdıñ qazaq bölımderınıñ (bakalavriat) studentterıne arnalğan oqu qūraly / K.K. Ahmedärov, Ş.Q. Jarqynbekova redaksialağan. – 4-şı basylym. – Almaty: «Evero», 2019. – 241 b. 2. Juravleva E.A., Asmağambetova B.M., Taşimhanova D.S., İavorskaia E.E., Te M.V., Eşekeneva A.K. Käsıbi orys tılı: oqu-ädıstemelık qūral / E.A. Juravlevanyñ jalpy redausialauymen. – Almaty: «Evero» baspasy, 2021. – 242 b.

Module 4

Module code and name	PhCS 14114 Physical Training
Semester(s), when the module is taught	1,2,3,4
Responsible for module person	Marchibaeva U.S., Nazarkina O.N.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Practices
Workload (incl. contact hours, self-study hours)	Total workload: 60 hours - 1,2,3,4 sem. (240 hours per year). Practical: 60 h -1,2,3,4 sem. (240 hours per year).
Credit points (total by discipline)	2 ECTS per semester, total - 8 ECTS
Required and recommended prerequisites for joining the module	To master the course of physical culture, knowledge, skills and abilities acquired in the study of the following disciplines are necessary: anatomy, pedagogy, biology.
Module objectives/intended learning outcomes	Formation of competencies in physical culture, aimed at developing the student's personality and the ability to use the means and methods of physical culture and sports for the preservation and promotion of health, psychophysical training and self-preparation for future life and professional activities. Willingness to apply methods, means, fundamentals of the theory and methodology of physical culture and sports to ensure a full-fledged social and professional activity. - formation of a healthy lifestyle and lifestyle; - independently select and apply methods and means of physical culture for the formation and improvement of basic physical qualities and motor skills; -correctly perform physical exercises, calculate the dosage of the exercise and make up sets of exercises for the development of basic physical qualities. -preparation for professional activity and service in the Armed Forces of the Republic of Kazakhstan;
Content	The discipline "Physical culture" is the most important component of the integral development of the personality. Being an integral part of the general culture and professional training of a student throughout the entire period of study, physical culture is an obligatory section in all components of education, the significance of which is manifested through the harmonization of spiritual and physical forces, the formation of such universal values as health, physical and mental well-being, physical perfection . It ensures the continuity of the educational process with the programs of physical education of students in schools and secondary specialized educational institutions.
Examination forms	Differentiated offset
Study and examination requirements	Students who have not attended all the practical classes are not allowed to take a differentiated test. Repetitions of the topic and working out of the materials covered for each training session are required. The degree of mastering the educational practical material is checked by testing the physical fitness of students. Students may be tested without warning.
Technical, multimedia tools and software	Sports simulators, sports equipment, TV and video equipment

Reading list	1. Moiseyeva N.A.Gimnastika s metodikoy prepodavaniya : uchebnoye posobiye / N.A. Moiseyeva. - Almaty : New book, 2020. - 152, [1] s. : il., tabl. - Bibliogr.: s. 147. - ISBN 978-601-301-906-2.75.6ya7 2. Borodikhin V.A.Zdorov'yesberegayushchaya napravlennost' fizicheskogo vospitaniya i sporta shkol'nikov i uchashcheysya molodozhi : [monografiya] / V.A. Borodikhin, ZH.A. Usin, ZH.A. Usina. - Almaty : SSK, 2019. - 302, [1] s.: diagr., tabl. - Bibliogr. v kontse chastey. - ISBN 978-601-327-892-6.75.1 3. Teoriya i metodika obucheniya bazovym vidam sporta. Legkaya atletika : uchebnik dlya obrazovatel'nykh uchrezhdeniy vysshego professional'nogo obrazovaniya, po napravleniyu podgotovki "Fizicheskaya kul'tura" / G.V. Gretsov, S.Ye. Voynova, A.A. Germanova i dr.; pod redaktsiyey G.V. Gretsova i A.B. Yankovskogo. - 3-ye izd., ispr. - Moskva: Akademiya, 2016. - 287, [1] c: il., tabl. - (Vyssheye obrazovaniye. Fizicheskaya kul'tura i sport) (Bakalavriat). - Bibliogr.: s. 284-286. - ISBN 978-5-4468-3134-0. 4. Marchibayeva U.S. Metodicheskiye osnovy fizicheskoy kul'tury: elektronnyy uchebnik / Mubarakkyzy B.M., Tashkeyev D.S., Kulanova K.K.,Sidorova R.V. Astana: YENU im. L.N. Gumileva, 2015. Svidetel'stvo o gosudarstvennoy registratsii prav na obyekt avtorskogo prava. IS 002796.

Module 5

Module code and name	CSSE 11005 Information and Communication Technologies
Semester(s), when the module is taught	2
Responsible for module person	Karymsakova A.E.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Interactive, project method, case study, student-centered learning
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Informatics
Module objectives/intended learning outcomes	The purpose of using ICT multimedia in the educational process is determined by the possibility of implementing intensive forms and methods of teaching, strengthening the motivational component of learning through the use of modern means of processing audiovisual information, increasing the level of emotionality of its perception, and developing skills to implement various forms of independent information processing activities. Knowledge: – to explain the purpose, content and development trends of information and communication technologies, to justify the choice of the most appropriate technology for solving specific problems; to know the features of the use of multimedia on the Internet; – to explain methods of collecting, storing and processing information, ways of implementing information and communication processes; to develop multimedia content; – to describe the architecture of computer systems and networks, the purpose and functions of the main components; – to use information Internet resources, cloud and mobile services to search, store, process and disseminate information; – to apply software and hardware of computer systems and networks for collecting, transmitting, processing and storing data; – to analyze and justify the choice of methods and means of information protection; – using digital technologies to develop analysis and data management tools for various types of activities; – to carry out project activities in the specialty using modern information and communication technologies. Competencies: – mastering by students of the conceptual foundations of the architecture of computer systems, operating systems and networks; evaluate the effectiveness of digitalization in professional areas; – formation of knowledge about the concepts of developing network and web applications, information security tools; – developing skills in the use of modern information and communication technologies in various areas of professional activity, scientific and practical work, for self-education and other purposes.
Content	The role of ICT in key sectors of the development of society. ICT standards. Introduction to computer systems. Architecture of computer systems. Software. Operating Systems. Human-computer interaction. Database systems. Data analysis. Data management. Networks and telecommunications. Cybersecurity. Internet technologies. Cloud and mobile technologies. multimedia technologies. Smart technologies. Electronic technologies. Electronic business. E-learning. Electronic government. Information technologies in the professional sphere. Industrial ICT. Prospects for the development of ICT.
Examination forms	Computer testing

Study and examination requirements	Mandatory attendance of online and classroom classes, active participation in the discussion of issues, preliminary preparation for lectures and practical exercises, high-quality and timely completion of tasks of the INDEPENDENT WORK OF STUDENTS, participation in all types of control.
Technical, multimedia tools and software	Personal computer, interactive whiteboard
Reading list	1. Brown G., Sargent B., and Watson D. Cambridge IGCSE ICT. - London: Hodder Education Group, 2015. -439 p. 2. Williams B. K. and Sawyer S. Using information technology: A practical introduction to computers & communications. - New York: McGraw-Hil., - 8th ed. -2010. -563 p. 3. Watson D. and Williams H. Cambridge IGCSE Computer Science: Hodder Edu.; 3 ed. 2015.-278 p. 4. Evans V. Information technology. Books 1-3: English for specific purposes.- 5th impr.- Newbury: Express Publishing, 2014.- 40 p.

Module 6

Module code and name	ECON 22001 Entrepreneurship and Business
Semester(s), when the module is taught	3
Responsible for module person	Ryspekova M.O.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (elective component)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: knowledge of the basics of economics within the framework of the secondary school program "Economics and Entrepreneurship".
Module objectives/intended learning outcomes	“Entrepreneurship and business” is the acquisition of the necessary entrepreneurial skills, understanding the mechanism of the functioning of the market structure in business. Knowledge: familiarity with the theory of business and entrepreneurship, systematization of regulatory, economic, organizational and managerial knowledge on the formation, conduct of entrepreneurship and business. Skills: cognitive and practical skills to develop an entrepreneurial mindset to solve specific problems and business situations. Skills in preparing, evaluating and implementing business development projects in various sectors of the economy; skills of organizing, reorganizing and liquidating business firms and preparing working documentation - tools for regulating economic relations between business entities. Competences: to form the readiness of students for entrepreneurial activity and for organizing their own business. Skills in preparing, evaluating and implementing business development projects in various sectors of the economy. Collect, analyze and process the data necessary to solve the set economic tasks in the field of business organization and development; Select and apply economic data processing tools in the field of business organization and management in accordance with the task, analyze the results of economic efficiency calculations and substantiate the conclusions.
Content	Introduction to Entrepreneurship and Business. Essence of business and entrepreneurship. Goals, functions and general characteristics of the business. Modern business system: subjects of business relations, business infrastructure, government support. Business forms. Small, medium and large businesses. Registration of a business company. Organization of a business firm. Reorganization and termination of the company. Economic activity in the business system. Business competition. Business activity and contracts of the firm. Tax system in business. Business interests in business. Entrepreneurial risk. Innovative entrepreneurship. Business infrastructure.
Examination forms	Oral exam
Study and examination requirements	Organization of the lesson using active forms and methods of the educational process, mandatory control. The exam serves as a form of checking the educational achievements of students throughout the professional curriculum of the discipline and provides for the development of educational achievements of students for the academic period, the theoretical knowledge gained, the strength of their assimilation, creative thinking, and independent work skills.
Technical, multimedia tools and software	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).

Reading list	1. Esirkepova A.M. Sovremennoe predprinimatel'stvo: uchebnoe posobie /A.M. Esirkepova. - Almaty: New book, 2020. – 304 s. 2. Bajgelova A.N. Osnovy predprinimatel'stva: uchebnoe posobie /A.N. Bajgelova, ZH.E. Sadykova, T.M. Nasymhan. - Almaty: Lantar Trejd, 2019. - 292 s. 3. Ryspekova M.O. Osnovy predprinimatel'stva: uchebnoe posobie. - Almaty: Epigraf, 2019. – 231 s. 4. Majdyrova A.B. Predprinimatel'stvo i biznes: kejsy, delovye igry, zadachi i skhemy: uchebnoe posobie /A.B. Majdyrova, R.A. Bajzholova. - Nur-Sultan: ENU im. L.N. Gumileva, 2020. – 172 s. 5. Majdyrova A.B. Ekonomika malogo i srednego predprinimatel'stva: uchebnoeposobie /A.B. Majdyrova, M.O. Ryspekova. - Nur-Sultan: ENU im. L.N. Gumileva, 2019. -251 s.

Module 7

Module code and name	BSRM 22005 Basics of scientific research methodology
Semester(s), when the module is taught	3
Responsible for module person	Zhumadilov K.Sh.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (elective component)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Mechanics, molecular physics and thermodynamics
Module objectives/intended learning outcomes	The purpose of the module is to study the methodological foundations of scientific knowledge. Learning outcomes: - To know the methods of theoretical research; - To be able to choose the right direction of scientific research; - To know how to search, accumulate and process scientific information, as well as process and formalize the results of experimental studies.
Content	Methodological foundations of scientific knowledge. Definition of science. Science and other forms of exploration of reality. The concept of scientific knowledge. Methods of scientific knowledge. Ethical and aesthetic foundations of the methodology. Choice of the direction of scientific research. Statement of a scientific and technical problem and stages of research work. Methods of choice and goals of the direction of scientific research. Search, accumulation and processing of scientific information. Documentary sources of information. Electronic forms of information resources. Theoretical and experimental studies. Methods and features of theoretical research. General information about experimental studies.
Examination forms	Oral exam
Study and examination requirements	Mandatory activity of students in the educational process, which is assessed by the quality of their performance. Attendance at classes and participation in the educational process are mandatory. Students should not miss classes without a valid reason. Late arrivals are not allowed. The code of conduct and ethics must comply with the requirements of the university. In this regard, marks are given from 0 to 100 points.
Technical, multimedia tools and software	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).
Reading list	1. Ponomarev A.B. Metodologiya nauchnyh issledovanij: ucheb. posobie / A.B. Ponomarev, E.A. Pikuleva. – Perm': Izd-vo Perm. nac. issled. politekhn. un-ta, 2014. – 186 s. 2. Novikov A.M., Novikov D.A. Metodologiya nauchnogo issledovaniya. – M.: Librokom, 2010. – 280 s. 3. Krampit A.G., Krampit N.YU. Metodologiya nauchnyh issledovanij. – Tomsk: Izd-vo Tom. politekhn. un-ta, 2008. – 164 s.

Module 8

Module code and name	CSSE 22002 Digital technologies by branches of application
Semester(s), when the module is taught	3
Responsible for module person	Mukhtarova A.Zh.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (elective component)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Information and Communication Technologies
Module objectives/intended learning outcomes	Purpose: to introduce students to the prospects and examples of using digital technologies to improve the efficiency and quality of their activities. Knowledge: – to study the basic concepts of digital technologies, platforms and mobile devices; - know the features of using multimedia on the Internet; – be able to effectively use digital technologies and Internet resources; - develop multimedia content; - use the functionality of social networks; - use various means of processing and storing digital information; – analyze the reliability of means and methods of protection in the network; Competencies: - the formation of students' skills and abilities necessary for their further professional activities; – evaluate the effectiveness of digitalization in professional areas. – to synthesize the effective use of Internet services for work and life.
Content	Introduction to the course. State program "Digital Kazakhstan". Smart city. Basic concepts. Platforms and technologies of the organization. Roadmap of smart Astana. Computer networks. Internet. Internet access technologies. Internet by wire. Internet without wires. Mobile Internet. Mobile networks (3G, 4G/LTE). Cellular systems. Digital platforms for electronic public services. Electronic digital signatures (EDS). Information system "Electronic licensing". Digital e-commerce platforms. Electronic commerce. Virtual payment means and systems. Internet shops. Online shopping. Information security on the Internet. Cybersecurity. Strong passwords. two-step authentication. 3D modeling and animation. 3D graphics. 3D modeling. Virtual and augmented reality VR and AR. Introduction to Java. Java programming language. Introduction to the Python programming language. Processing of digital information in the professional field. Organization of texts, transformation of textual information. Processing of graphic images. Compression of digital information. Database. Big data and open data. Statistical processing of results using the program STATISTICA. Modern multimedia services. Social networks. Search engines. Electronic catalogs, libraries. Videoconferencing. The use of cloud technologies for storing digital information. General concepts of cloud technologies. Advantages and disadvantages of cloud services.
Examination forms	Testing
Study and examination requirements	The course "Digital Technologies by Industry" is an optional component. The work must be completed within the specified time frame. Students who do not complete all tasks are not allowed to take the exam. Refinement of the topic and development of the materials covered for each training session are required. The degree of assimilation of educational material is checked by testing. Students may be tested without warning.
Technical, multimedia tools and software	Programs Python, Java, STATISTICA

Reading list	1. Brown G., Sargent B., and Watson D. Cambridge IGCSE ICT. - London: Hodder Education Group, 2015. -439 p. 2. Williams B. K. and Sawyer S. Using information technology: A practical introduction to computers & communications. - New York: McGraw-Hil., - 8th ed. -2010. -563 p. 3. Watson D. and Williams H. Cambridge IGCSE Computer Science: Hodder Edu.; 3 ed. 2015.-278 p. 4. Evans V. Information technology. Books 1-3: English for specific purposes.- 5th impr.- Newbury: Express Publishing, 2014.- 40 p.

Module 9

Module code and name	LAWS 22007 Anti-corruption culture
Semester(s), when the module is taught	3
Responsible for module person	Ibragimov Zh.I., Temirzhanova L.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (elective component)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	School course "Man, society and law"
Module objectives/intended learning outcomes	The purpose of the anti-corruption culture is the education of values and the development of abilities necessary for the formation of a civil position in young people in relation to corruption, the formation of a negative attitude towards corruption manifestations. Learning outcomes: Students will gain knowledge about the essence of corruption and the causes of its occurrence. Students will be able to analyze the measure of moral, ethical and legal responsibility for corruption offenses. Students will be familiar with the anti-corruption policy of the state and the current anti-corruption legislation. Students will be able to realize the values of moral consciousness and follow moral standards in daily practice. Students will be able to determine the legal course of action in a situation of conflict of interest.
Content	The Fundamentals of Anti-Corruption Culture course aims to raise awareness of corruption and shape its image as a public policy issue. The purpose of studying the course is to form a system of knowledge on combating corruption, the existing legal responsibility and the development on this basis of a civil position in relation to this phenomenon. Development of a legal culture of an individual that contributes to the fight against corruption, the formation of skills and abilities for a critical analysis of corruption phenomena, the study of modern anti-corruption approaches and practices.
Examination forms	Computer testing
Study and examination requirements	Students are required to attend lectures and seminars, preparing in advance for lectures and seminars on the basis of textbooks and basic literature, participate in all types of control (current control, midterm control, final control), mandatory participation in intermediate and final certification tests, fulfillment of teacher's tasks. The activity of work at the seminar (the ability to lead a discussion, to argue one's position with references to the literature studied, a creative approach to the selection and analysis of texts), the quality of individual written assignments (glossary, etc.) and creative work (essays) are highly valued.
Technical, multimedia tools and software	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).

Reading list	Basic references: 1. Osnovy antikorruptsionnoy kul'tury: uchebnoye posobiye. Pod obshchey redaktsiyey d. b. n., professora B.S. Abdrasilova. – Astana: Akademiya gosudarstvennogo upravleniya pri Prezidente Respubliki Kazakhstan, 2016. – 176 s. 2. Protivodeystviye korruptsii. Uchebnik i praktikum. Pod obshchey redaktsiyey Ye.V.Okhotskogo. – Moskva, 2016. 3. Protivodeystviye korrptsii: konstitutsionno-pravovyye podkhody. Kollektivnaya monografiya\ otv. Avak'yan S.A – M.: Yustitsinform, 2016. – 512s. 4. Rouz-Akkeman S. Korruptsiya i gosudasrstvo. Prichiny, sledstviya, reformy. M.: Logos, 2010. 5. Antikorruptsionnaya pravovaya politika: ucheb. posobiye / Ye. Alaukhanov. – Almaty: Zan adebiyeti, 2009. – 256 s. 6. Nravstvennost' kak osnova stanovleniya novoy generatsii gosudarstvennykh sluzhashchikh. / Kabykenova B.S., Shakhanov Ye.A., Dzhusupova R.S./. 2011. 7. Byurokratiya, korruptsiya i effektivnost' gosudarstvennogo upravleniya / V. D.Andrianov. - M.: Volters Kluver, 2009. - 248 s. - Bibliogr.: 234 s. 8. Korruptsiya i gosudarstvo: Prichiny, sledstviya, reformy: Per. s angl. O.A.Alyakrinskogo / S. Rouz-Akkerman. – M.: Logos, 2003. - 356 s. 9. Vlast', korruptsiya i chestnost': Nauch. izd.: Per. s angl. / A. A. Rogou. – M.: Izd-vo RAGS, 2005. – 176 s. (Antologiya zarubezh. i otech. mysli)

Module 10

Module code and name	ECLFST 22004 Fundamentals of ecology and life safety
Semester(s), when the module is taught	3
Responsible for module person	Kobetaeva N.K.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (elective component)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	School biology course
Module objectives/intended learning outcomes	Formation of an ecological outlook, obtaining deep systemic knowledge and ideas about the basics of ecology and life safety, theoretical and practical knowledge about modern approaches to the rational use of natural resources and environmental protection. As a result of studying this discipline, students should know: - the main patterns of interaction between nature and society; - fundamentals of functioning of ecosystems and development of the biosphere; - impact of harmful and dangerous production factors and environment on human health; - concept, strategies, problems of sustainable development and practical approaches to their solution at the global, regional and local levels; - Fundamentals of environmental legislation; - principles of organization of safe production processes; be capable of: - assess the ecological state of the natural environment; - to assess the technogenic impact of production; the environment have the skills to: - study of the components of ecosystems and the biosphere as a whole; - determination of optimal conditions for sustainable development of ecological and economic systems; - conducting a logical discussion of topics related to the solution of environmental problems; - knowledge of standard environmental monitoring methods
Content	Ecology and problems of modern civilization. Autoecology is the ecology of organisms. Demecology is the ecology of populations. Synecology-Ecology of the Community. Biosphere and its sustainability. Evolution of the biosphere. The concept of living matter. modern biosphere. Global biogeochemical cycles. Ecological crisis and problems of modern civilization. Strategies, goals and principles of safety and life. Green economy and sustainable development. Natural resource management. Ecoenergy. Global energy-ecological strategy for sustainable development XXI century. Water is a strategic resource of the 21st century. Renewable energy sources. Ecological policy of the Republic of Kazakhstan. The concept of sustainable development of the Republic of Kazakhstan. Atmospheric protection. Protection of water resources. Protection of land resources, soils and subsoil. Physical pollution of the environment. Protection of flora and fauna.
Examination forms	Computer testing

Study and examination requirements	Students are required to attend lectures and seminars, preparing in advance for lectures and seminars on the basis of textbooks and basic literature, participate in all types of control (current control, midterm control, final control), mandatory participation in intermediate and final certification tests, fulfillment of teacher's tasks. The activity of work at the seminar (the ability to lead a discussion, to argue one's position with references to the literature studied, a creative approach to the selection and analysis of texts), the quality of individual written assignments (glossary, etc.) and creative work (essays) are highly valued.
Technical, multimedia tools and software	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation)
Reading list	1 Akimova T. A., Haskin V. V. Ekologiya. CHelovek-ekonomika-biota-okruzhayushchaya sreda: Uchebnik dlya studentov vuzov / 2-e izd., reprint. i prilozhenie-M: EDINSTVO, 2009. – 556 s. 2 Bigaliev A.B. Obshchaya ekologiya / Izdanie vtoroe, pererab. dopolnen. - Almaty: Izdatel'stvo NURPRESS, 2011. 3 Denisova V. V. Ekologiya: Uchebnik – M., 2004. 4 Abubakirova K. D., Kozhagulov S. O. Ekologiya i ustojchivoe razvitie. - Almaty, 2011 g. 5 Kolumbaeva S.ZH. i drugie. Ekologiya i ustojchivoe razvitie. - Almaty, «Kazahskij universitet», 2011 g. 6 Alimov M.SH. Ekologiya i ustojchivoe razvitie. - Almaty, 2012 g. 7 Korobkin V. I., Peredel'skij L. V. Ekologiya: Uchebnik dlya studentov vuzov. - Rostov n/D: Feniks, 2007-575 s. 8 Tonkopij M. S., Satbaev G. S., Imkulova N. P., Anisimova N. M. Ekologiya zhane turakty damu: okulyk: KR Bilim zhane gylym m-gi. Almaty: ZHSHS RPBK "Dauir", 2011-312 b. 9 Kolumbaeva S.ZH. ZHalpy ekologiya. - Almaty: 2006 g.

Module 11

Module code and name	COMU 22003 Business rhetoric
Semester(s), when the module is taught	3
Responsible for module person	Shakhin A.A., Tashimkhanova D.S.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (elective component)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Russian / Kazakh
Module objectives/intended learning outcomes	The goal is to develop the skills of effective public speaking, the skills of successful communication in various situations of business communication. Know the main rhetorical strategies and tactics, methods of argumentation aimed at achieving a communicatively meaningful result. To be able to apply knowledge of oratorios to the speech facts of business communication; build effective business communication in accordance with the students' own communicative intentions. Possess the skills of effective interaction with participants in the process of business communication in various genres of business communication.
Content	The course has a professional and practical focus. Its study involves mastering the technology of rhetorical activity in professionally significant situations. The objectives of the course include improving the speech education of students, gaining knowledge about the principles of effective business communication, the main factors and processes that ensure the successful impact of public speaking on listeners, forms and means of interaction between the speaker and the audience. The student gains knowledge about the main rhetorical strategies and tactics aimed at achieving a communicatively meaningful result; fundamentals of public speaking skills; knowledge of the terminological apparatus of the course; the ability to produce tests of an official business orientation, to be aware of one's own communicative intentions and to build effective business communication in accordance with this.
Examination forms	Combined exam
Study and examination requirements	Mandatory activity of students in the educational process, which is assessed by the quality of their performance. Attendance at classes and participation in the educational process are mandatory. Students should not miss classes without a valid reason. Late arrivals are not allowed. The code of conduct and ethics must comply with the requirements of the university. In this regard, marks are given from 0 to 100 points.
Technical, multimedia tools and software	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).
Reading list	1. Sternin I.A. Prakticheskaya ritorika: ucheb. posobiye dlya studentov vysshikh uchebnykh zavedeniy. – M.: «Akademiya», 2016. – 272 s. 2. Shelamova G.N. Etiket delovogo obshcheniya: ucheb. posobiye dlya nach. prof. obrazovaniya. – M.: "Akademiya», 2015. – 192 s. 3. Vvedenskaya L.A. Delovaya ritorika: Uchebnoye posobiye dlya vuzov. – Rostov n/D, 2012. 4. Mal'khanova I.A. Delovoye obshcheniye: ucheb. posobiye. – M.: Akademicheskiy Proyekt, 2014. – 224 s. 5. Anisimova T.V., Gimpel'son Ye.G. Sovremennaya delovaya ritorika: ucheb .posobiye. – M. : NPO «MODEK», 2017. – 432 s. 6. Golub I.B. Ritorika: ucheb. posobiye. – M.: «Eksmo», 2015.– 384 s. 7. Kuzin F.A. Kul'tura delovogo obshcheniya. – M., 2017.

Module 12

Module code and name	PHIL 21002 Philosophy
Semester(s), when the module is taught	4
Responsible for module person	Tolgambayeva D.T.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Flipped class, problem lecture, case studies, brainstorming, game methods
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	History of Kazakhstan, Culturology
Module objectives/intended learning outcomes	The purpose of the course is to form students' holistic systemic understanding of philosophy as a special form of knowledge of the world, its main sections, problems and methods of studying them in the context of future professional activities. - Know the meaning of the main philosophical concepts and categories, the content of the main philosophical concepts regarding fundamental philosophical problems, the patterns of development of nature, society and thinking; - Be able to apply the conceptual and categorical apparatus, the basic laws of the humanities and social sciences in professional activities; apply methods and means of cognition for intellectual development, raising the cultural level, professional competence; analyze the processes and phenomena occurring in society; interpret philosophical texts (primary sources and commentary literature), as well as express their interpretation both in writing and orally; - Have the skills of philosophical thinking to develop a systematic, holistic view of the problems of society; competently express and argue their point of view (orally and in writing) when borrowing and interpreting one or another of the learned ideas and concepts, the ability to trace the relationship between various traditions and trends.
Content	The emergence of a culture of thinking. The subject and method of philosophy. Fundamentals of philosophical understanding of the world. Consciousness, soul and language. Being. Ontology and metaphysics. Knowledge and creativity. Education, science, engineering and technology. Man and the Universe. World of things. Life and death. Meaning of life. Ethics. Philosophy of values. Axiology and morality. Philosophy of freedom. The concept of freedom in the history of philosophy. Philosophy of art. Society and culture. Philosophy of history. Philosophy of religion. “Mangilik el” and “Rukhani zhangyru” are the philosophy of the new Kazakhstan.
Examination forms	Computer testing
Study and examination requirements	Class attendance and active participation in the learning process are mandatory. High-quality and timely fulfillment of the tasks of the INDEPENDENT WORK OF STUDENTS, actively participate in the oral survey conducted by the teacher during classes, written express control. The preparation by the student of messages (reports) on certain issues of the topic being studied, participation in a free discussion organized by the teacher in order to consolidate and deepen the knowledge gained in lectures and in the process of independent work also contributes to a significant increase in the level of knowledge. For the qualitative mastering of the course, the student must be guided by the fact that he independently works with texts, approximately 40-60 pages per week. To successfully pass the final control, the student will have to pass test tasks in Platonus in the amount of 40 questions.
Technical, multimedia tools and software	Computer, projector, and applications: mook.enu.kz, moodle.enu.kz

Reading list	1. Abdil'din ZH.M., Abdil'dina R.ZH.. Istoriya filosofii. – Almaty, Asem-Sistem, - 2010. – 258 s. 2. Hess R. Filosofiyanyң taңdauly 25 kitaby. /Ғylymi red. Raev D.S. – Astana, 2018. –360 b. 3. Esim, G.. Metafizika cheloveka.- Almaty, 2012 4. Mironov V.V.Filosofiya. Uchebnik. – M.: Prospekt, 2016. – 289 s 5. Masalimova A.R., Altaev ZH.A., Kasabek A.K. Kazahskaya filosofiya. Uchebnoe posobie. – Almaty, 2018 6. Dzhonston D. Kratkaya istoriya filosofii/ per. E.E. Suharev. –M.: Astrel', 2010. – 236 s 7. Esim, G.. Hakim Abaj.- Astana, 2012 8. Esim, G.. Mudrost' SHakarima.- Almaty, 2008

Module 13

Module code and name	BCOM 22202 Basics of Computing Physics
Semester(s), when the module is taught	4
Responsible for module person	Sailaubek D.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Laboratory: 30 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Programming Technology
Module objectives/intended learning outcomes	The objective of the module is to develop skills of students in basics of programming using the Python language. Learning outcomes are: - to provide numerical calculations in Python; - to create animations; - to plot 2D and 3D graphs; - to apply data collection and analysis
Content	Python basics: NumPy, functions, loops, conditionals, lists, arrays, plots. Numerical methods: Derivatives and integrals, differential equations and eigenvalue problems, interpolation and Monte Carlo methods. Practice at Physics Problems: Moment of inertia, magnetic field of a wire, radioactive decay, harmonic oscillators, free fall, rolling balls.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	MOOC, online videos, presentations
Reading list	1. E. Matthes Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming. 2019. - 544 p. ISBN-13: 978-1593279288. 2. B. Jayne Python Programming Language. QuickStudy Reference Guides, 2019. ISBN-13: 978-1423241881. 3. O. Moore PYTHON FOR BEGINNERS: Enter the Real World of Python and Learn How to Think Like a Programmer. - Independently published, 2022. - 142 p. ISBN-13: 979-8408663415.

Module 14

Module code and name	HIST 11001 Modern history of Kazakhstan
Semester(s), when the module is taught	5
Responsible for module person	Kushenova G.I.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Problem learning
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	School course of History of Kazakhstan.
Module objectives/intended learning outcomes	The purpose of the course is to form a system of scientific views on the history of modern Kazakhstani society in the context of the world historical process. Expected learning outcomes: - to systematize the conceptual foundations for studying the modern history of Kazakhstan; compare ideas about the continuity and continuity of historical and cultural development, the deep roots of the spiritual heritage of Kazakhstan; - reveal the significance of the formation of historical consciousness and worldviews in accordance with national priorities; - to classify historical sources reflecting the features of the modern history of Kazakhstan; - to identify the historical patterns of the development of society, paying attention to the study of historical originality; - master the techniques of historical description and analysis of the causes and consequences of the events of the modern history of Kazakhstan; - predict possible solutions to modern problems based on the analysis of the historical past and reasoned information; - to argue the features and significance of the modern Kazakh model of development; - explain the importance of educating patriotism in the spirit of the democratic values of modern society using the example of the life of historical figures.
Content	Introduction to the course. Kazakhstan on the way to independence: stages of formation of the idea of a national state. Civil-political confrontation. Implementation of the Soviet model of state building. Contradictions and consequences of Soviet reforms in Kazakhstan in the second half of the twentieth century. Formation of the state structure of the Republic of Kazakhstan. Kazakhstani model of economic development. Social modernization is the basis for the well-being of society. Ethno-demographic processes and strengthening of interethnic harmony. Prospects for socio-political development and spiritual modernization. The policy of forming a new historical consciousness and worldview of the peoples of the Great Steppe. Kazakhstan is a state recognized by the modern world. Nazarbayev is a personality in history. Formation of a nation of a single future.
Examination forms	At the end of the semester, the State Oral Examination is held. Exam tickets are used to pass the state exam.
Study and examination requirements	The activity of students in the educational process is obligatory, which is evaluated by the quality of implementation. Attendance at classes and participation in the educational process are mandatory. Students should not be absent from class without a valid reason. Late arrivals are not allowed. The code of conduct and ethics must comply with the requirements of the university. In this regard, marks are given from 0 to 100 points.
Technical, multimedia tools and software	Presentation projector

Reading list	1. Ayagan B.G., Abzhanov Kh.M., Seliverstov S.V., Bekenova M.S. Sovremennaya istoriya Kazakhstana: Almaty: Raritet, 2010. – 432 s., 16 s. 2. Kan G.V. Istoriya Kazakhstana: Uchebnoye posobiye dlya vuzov. – Almaty, 2005. 3. Uly Dala tarikhy: uchebnoye posobiye / Kan G.V., Tugzhanov Ye.L. – Astana: Zhasyl Orda, 2015. – 328 str. 4. Momynova Sh.R. Kazakhstan: drevneyshaya, drevnyaya i srednevekovaya istoriya. V 2 tomakh. - Karaganda, 2003 5. Kazakstan tarikhy. 5 tomdyk. 1-5-tomdar. – Almaty., 1996, 1997, 2000, 2010. 6. Kazakstan (Kazak Yeli) tarikhy. – 4 kytaptan turatyn okulyk. Tauelsiz Kazakstan: algyzharttary zhane kalyptasuy. 4 kytap / T. Omarbekov, B.S. Saylan, A.Sh. Altayev zhane t.b. – Almaty, Kazak universitety, 2016. – 264 b. 7. Uly Dala Tarikhy: uchebnoye posobiye /Kan G.V., Tugzhanov Ye.L. – Astana: Zhasyl Orda, 2015. – 328 s. 8. Ayagan B.G., Abzhanov Kh.M., Makhat D.A. Kazirgi Kazakstan tarikhy. – Almaty, 2010.

Module 15

Module code and name	EDUC 22001 Social and Political Knowledge Module
Semester(s), when the module is taught	6
Responsible for module person	Burbaeva P.T
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Flipped class, problem lecture, case studies, brainstorming, game methods
Workload (incl. contact hours, self-study hours)	Total workload: 240 hours. Lectures: 30 hours, practical: 60 hours, independent work of students: 150 hours.
Credit points (total by discipline)	8 ECTS
Required and recommended prerequisites for joining the module	History of Kazakhstan, Culturology
Module objectives/intended learning outcomes	The purpose of studying the course: the formation of the socio-humanitarian outlook of students in the context of solving the problems of modernizing public consciousness, defined by the state program "Looking into the Future: Modernizing Public Consciousness". Expected learning outcomes based on the results of mastering the course: - to explain and interpret the subject knowledge (concepts, ideas, theories) of sociology that make up the training courses of the module; - explain the socio-ethical values of society as a product of integration processes in the systems of basic knowledge of the courses of the socio-political module; - algorithmically represent the use of scientific methods and research techniques in the context of specific training courses and in the procedures for interacting module courses; - to explain the nature of situations in various areas of social communication based on the content of theories and ideas of the scientific areas of the courses being studied; - reasonably and reasonably provide information about the various stages of development of Kazakhstani society, public and interpersonal relations; - to analyze the features of a social institution in the context of their role in the modernization of Kazakhstani society.
Content	Subject and object of science. Introduction to the theory of sociology. sociological theory. The development of individual schools and trends (O. Comte, G. Spencer, E. Durkheim, M. Weber, K. Marx). Social structure and stratification of society. Society, equality and inequality. Open and closed society. Stratification as a structured inequality between different groups. Systems of stratification and differentiation. Brief review of theories of social stratification (K. Marx, M. Weber). Forms of social stratification (P. Sorokin). social mobility. Horizontal and vertical mobility. Socialization and identity. Relations between the individual and society. Theories of socialization and identity. (T. Parsons, G. H. Mead). Stages of socialization. primary socialization. Average socialization. Adult stage of socialization. Gender socialization. Gender order. Identity and personality. Social and personal identity. Roles and statuses. Sociological research. Sociological research design. Explore the issue. Hypotheses. Variables. Sample. Information collection methods. Qualitative and quantitative. Data analysis.
Examination forms	Computer testing
Study and examination requirements	Students are required to attend lectures and seminars, preparing in advance for lectures and seminars on the basis of textbooks and basic literature, participate in all types of control (current control, midterm control, final control), mandatory participation in intermediate and final certification tests, fulfillment of teacher's tasks. The activity of work at the seminar (the ability to lead a discussion, to argue one's position with references to the literature studied, a creative approach to the selection and analysis of texts), the quality of individual written assignments (glossary, etc.) and creative work (essays) are highly valued.
Technical, multimedia tools and software	PowerPoint, MindMeister, Miro.com, XMind, Lucidchart, Canva

Reading list	Basic references: 1. Biyekenov K.U., Biyekenova S.K., Kenzhakimova G.A. «Sotsiologiya: Uch. posobiye». – Almaty: Evero, 2016. – 584 s. 2. Äbdirayimova G.S. Jastar sociologiyasy: oku kuraly. 2-basylym. – Almaty: «Kazak universitety», 2012. – 224 s. 3. Brïnkerxof D, Weyts R., Ortega S. Aleumettanu negizderi.- Almaty: Ulttik audarma byurosy, 2018 4. Dj.Rïtcer, Dj. Stepnïckï Aleumettanu teoriyasi.- Almaty: Ulttik audarma byurosy, 2018. 5. Aitov N.K. Aleumettanu. Astana, 2015 6. Smagambet B.Zh. Sheteldik aleumettanu tarikhy. – Almaty: Evero, 2016.

Module 16

Module code and name	MATH 12001 Mathematics
Semester(s), when the module is taught	1, 2
Responsible for module person	Shomanova A.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 300 hours per year (150 hours per semester). Lecture: 30 hours. Seminar: 60 hours. Independent work of students: 210 hours.
Credit points (total by discipline)	10 ECTS
Required and recommended prerequisites for joining the module	For the successful completion of the module you need to know the mathematics of the secondary school.
Module objectives/intended learning outcomes	To own analysis of functions of one and several variables, the theory of series, multiple integrals, and be able to apply them in approximate calculations, geometrical, physical and applied problems. The Module "Mathematics" is aimed at familiarizing with the fundamental methods of investigating variables through the analysis of infinitesimal ones. The goal of the Module is to develop students' logical thinking, analytical and geometric intuition and mathematical culture, necessary for the study of any science. The Module consists of a differential and integral calculus of functions of one and several variables.
Content	Logic elements, differential and integral calculus, the theory of series. The Module "Mathematica" is aimed at studying the mathematical approach to the analysis of applied (fundamental) problems, as well as mathematical methods of research and solving such problems. The objectives of the discipline are to increase the level of fundamental mathematical training; strengthening the applied orientation of the Module, focusing on the use of mathematical methods in solving applied problems; the development of students' logical and algorithmic thinking, the ability to independently expand and deepen mathematical knowledge.
Examination forms	Oral exam
Study and examination requirements	Attending lessons, active participation at lessons, on time completion and submission of independent work of students, attending at rating weeks, passing the tasks of final control.
Technical, multimedia tools and software	MOOC, online videos, presentations
Reading list	1. J. Cummings Real Analysis: A Long-Form Mathematics Textbook (The Long-Form Math Textbook Series). – 2019. - 445 p. ISBN-13: 978-1077254541. 2. V. A. Zorich Mathematical Analysis I (Universitext). - Springer, 2nd ed., 2015. - 636 p. ISBN-13: 978-3662487907. 3. Adel N. Boules Fundamentals of Mathematical Analysis. - Oxford University Press, 2021. - 480 p. ISBN-13: 978-0198868781.

Module 17

Module code and name	DIFE 22202 Differential and integral equations
Semester(s), when the module is taught	3
Responsible for module person	Myrzataeva K.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours. Lecture: 30 hours. Seminar: 30 hours. Independent work of students: 120 hours.
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	Mathematics 1, 2
Module objectives/intended learning outcomes	To own methods for solving integral and differential equations, and be able to apply them in solving specific physical problems
Content	The module provides for the study of the basics of the theory of differential and integral equations of mathematical physics and practical methods of their solution. In the study, ordinary differential equations of first order, homogeneous, linear, higher order differential equations, linear operator, classification of integral equations, system of differential equations, etc. are considered. Basic concepts of differential equations. Physical problems leading to differential equations. Formulation of the Cauchy problem, the concept of its uniqueness. Existence and uniqueness of solutions of the Cauchy problem for equations of the first and n-th order, the normal system.
Examination forms	Oral exam
Study and examination requirements	It is planned to conduct ongoing control during classroom sessions, quality control of the self-work of students; two term controls in the form of a colloquium and testing
Technical, multimedia tools and software	MOOC, online videos, presentations
Reading list	1. Richard Bronson, Gabriel B. Costa Schaum's Outline of Differential Equations. - McGraw Hill, 2021. - 432 p. ISBN-13: 978-1264258826. 2. J.D. Logan A First Course in Differential Equations (Undergraduate Texts in Mathematics). - Springer, 2015. - 384 p. ISBN-13: 978-3319178516. 3. P. Blanchard, R.L. Devaney, G.R. Hall Differential Equations (with DE Tools Printed Access Card). - Cengage Learning, 2011. - 864 p. ISBN-13: 978-1133109037.

Module 18

Module code and name	THCV 23222 The theory of functions of a complex variable
Semester(s), when the module is taught	3
Responsible for module person	Akpaev B.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Mathematics 1, 2
Module objectives/intended learning outcomes	To own methods of analysis of the function of a complex variable, and be able to apply them in solving physical problems. The ability to form basic professional knowledge in general and theoretical physics, mathematics, electronics, which will allow to formulate the basic concepts of basic knowledge, physical problem solving, perform a physical experiment, work with applied programs and computer graphics programs, develop the ability for self-organization and self-education. To possess the basic principles, laws and methods of mathematics, reveal the natural scientific essence of the problem arising in the module of professional activity, apply the appropriate mathematical methods to solve them.
Content	The theory of functions of a complex variable is a section of mathematical analysis in which the functions of a complex argument are considered and studied. The module extends the class of real numbers and functions to a set of complex numbers, which allows the researcher to obtain new tools and capabilities that are not available in classical mathematical analysis. In many practical cases, it is possible to simplify both mathematical conclusions and representations of mathematical objects, which is important for simplifying modeling and effective technological applications.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	MOOC, online videos, presentations
Reading list	1. E.G. Phillips Functions of a Complex Variable (Dover Books on Mathematics). - Dover Publications, 2020. - 160 p. ISBN-13: 978-0486841946. 2. P. Franklin, K. Maestro Functions of A Complex Variable: A First Course. - Blue Collar Scholar/Createspace, 2018. - 277 p. 3. A. I. Markushevich Theory of Functions of a Complex Variable, Second Edition (3 vol. set). - American Mathematical Society, 2005. - 1138 p. ISBN-13: 978-0821837801.

Module 19

Module code and name	LINA 22229 Linear algebra
Semester(s), when the module is taught	4
Responsible for module person	Akpaev B.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Mathematics 1, 2
Module objectives/intended learning outcomes	The module objective is to develop knowledge in linear algebra and matrix theory. Learning outcomes are: - Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion; - Carry out matrix operations, including inverses and determinants; -To apply linear algebra for eigenvalue and eigenvector problem; -To apply QR-decomposition of matrices.
Content	Mathematical operations with matrices (addition, multiplication). Matrix inverses and determinants. Solving systems of equations with matrices. Euclidean vector spaces. Eigenvalues and eigenvectors. Orthogonal matrices. Positive definite matrices. Linear transformations. Projections. Linear dependence and independence. Singular value decomposition.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	MOOC, online videos, presentations
Reading list	1. G. Strang Introduction to Linear Algebra. - Wellesley-Cambridge Press, 2016. - 600 p. ISBN-13: 978-0980232776. 2. S. Axler Linear Algebra Done Right (Undergraduate Texts in Mathematics). - Springer, 2014. - 357 p. ISBN-13: 978-3319110790. 3. S. Lipschutz, M. Lipson Schaum's Outline of Linear Algebra, Sixth Edition. - McGraw Hill, 2017. - 432 p. ISBN-13: 978-1260011449.

Module 20

Module code and name	PRTC 13221 Programming technology
Semester(s), when the module is taught	1
Responsible for module person	Sailaubek D.A., Giniyatova Sh.G.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Laboratory classes: 30 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	
Module objectives/intended learning outcomes	The module objective is to introduce the Matlab system for mathematical calculations, data analysis, modeling of dynamic systems, and to develop the basic knowledge of writing algorithms. Learning outcomes of the module are: -understand programming basics; -construct simple algorithms for solution of physical problems -begin using MatLab language -create simple console applications
Content	Introduction to MatLab. MatLab overview. Syntax. Variables. Commands. M-Files. Data types. Operators. Decisions. Loops. Vectors. Matrix. Arrays. Colon notation. Numbers. Strings. Functions. Data import. Data output. Plotting in Matlab. Calculus. Differential and integration. Applications of Simulink.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	The MatLab system, online videos, presentations
Reading list	1. A. Gilat MATLAB: An Introduction with Applications, 6th Edition: An Introduction with Applications. - Wiley, 2016. - 414 p. ISBN-13: 978-1119385134. 2. C.S. Lent Learning to Program with MATLAB: Building GUI Tools. - Wiley, 2022. - 288 p. ISBN-13: 978-1119900474. 3. S.J. Chapman MATLAB Programming for Engineers. - Cengage Learning, 2019. - 864 p. ISBN-13: 978-0357030394.

Module 21

Module code and name	COMP 43221 Computing Physics
Semester(s), when the module is taught	8
Responsible for module person	Sailaubek D.A., Giniyatova Sh.G.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Laboratory classes: 30 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Information and communication technologies, Basics of Computing Physics
Module objectives/intended learning outcomes	The objective of the module is to enhance programming skills of students in the field of numerical methods and calculations. Learning outcomes are: -use numerical methods in calculations; -solve differential equations using modern software; -create complex projects and applications in MatLab, MatCAD.
Content	Overview and advanced study of numerical methods. The course is focused against practical aspects of computational physics and contain set-up and writing of software to solve physical problems particularly within molecular dynamics, statistical physics and material physics. Different aspects of molecular dynamics simulations, for example the precision of pair-potentials and the length of time steps, will be highlighted. Different aspects of stochastic and deterministic simulations by Monte Carlo simulations and Langevin methods will be discussed. Numerical aspects of electronic structure calculations with tight-binding approximation will be covered along with more sophisticated Hartree-Fock and Density Functional theory.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	MatLab, MathCAD,online videos, presentations
Reading list	1. J.F. Boudreau, E.S. Swanson Applied Computational Physics. - Oxford University Press, 2018. - 944 p. ISBN-13: 978-0198708643. 2. O.J. Scherer Computational Physics: Simulation of Classical and Quantum Systems. - Springer, 2017. - 1052 p. 3. J. Izaac, J. Wang Computational Quantum Mechanics. - Springer, 2018. - 507 p. 4. S. Attaway MATLAB: A Practical Introduction to Programming and Problem Solving. - Butterworth-Heinemann, 2022. - 592 p. ISBN-13: 978-0323917506.

Module 22

Module code and name	MMPH 33230 Methods of mathematical physics
Semester(s), when the module is taught	6
Responsible for module person	Sailaubek D.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Differential and integral equations Basics of vector and tensor analysis
Module objectives/intended learning outcomes	The module objective is to use the apparatus of mathematical physics methods to solve specific problems in physics, to develop the ability of independent thinking and broaden horizons in the field of theoretical and mathematical physics. Learning outcomes of the module are: -understand basic mathematical methods used in physics; -apply methods of functions of complex variables for calculations of integrals; -integrate the domain of concepts and knowledge from mathematics into practical application of physics phenomena. -solve differential and integral equations used in physical problems.
Content	Differential operators of Hamilton and Laplace. Equations in partial derivatives. The first order differential equations. Systems of linear equations. Hodograph method. Canonical form of of the 2nd order differential equations. Running waves. Separation of variables. Separation of variables in cylindrical coordinates. Separation of variables in spherical coordinates. Analytical theory of differential equations. Hypergeometric functions. Asymptotic methods. Generalized functions. Pass method.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Presentations
Reading list	1. A. N. Tikhonov, A. A. Samarskii Equations of Mathematical Physics. Dover Publications, 2011. - 800 p. 2. Budak B.M., Samarskij A.A., Tihonov A.N. A Collection of Problems in Mathematical Physics.- Dover Publications, 2011. – 800 p. 3. S.Hassani Mathematical Physics: A Modern Introduction to Its Foundations. - Springer, 2013. - 1236 p. ISBN-13: 978-3319011943.

Module 23

Module code and name	NMMM 43204 Numerical methods and mathematical modeling
Semester(s), when the module is taught	8
Responsible for module person	Sailaubek D.A., Giniyatova Sh.G.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours, Laboratory classes: 30 hours, Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Information and communication technologies
Module objectives/intended learning outcomes	The module objective is to develop computer-oriented computational algorithms for solving problems arising in the process of mathematical modeling of the physical phenomena. Learning outcomes are: -apply theoretical and numerical methods to study nuclear-physical phenomena and processes; -apply C++ programming language in solution of physical problems; -create console applications and graph models in C++
Content	Introduction to the C++ language. Control structures. Compound data types. Object oriented programming. Mathematical libraries math.h and cmath. Mathematical functions in C++. Solution of the linear algebra problems in C++: reverse matrix, Gaussian method, Seidel method, Jacobi method. Mechanical problems in C++: Kepler's problem, 2D- and 3D-gravitational motion, lagrangian of a particle. Modeling of nuclear reactions in C++.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Richard L. Halterman Fundamentals of C++ programming. Southern Adventist University, 2015. – 627 p. 2. Frank B. Brokken C++ Annotations Version 10.1.0. University of Groningen, Netherlands, 2014. – 978 p. ISBN 90 367 0470 7. 3. A. Greenbaum, T.P. Chartier Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms. - Princeton University Press, 2012. - 464 p. ISBN-13: 978-0691151229.

Module 24

Module code and name	MECH 11204 Mechanics
Semester(s), when the module is taught	1
Responsible for module person	Baratova A.A., Mauey B., Bayakhmetov O.S.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 240 hours. Lecture: 15 hours. Seminar: 30 hours. Laboratory classes: 30 hours. Independent work of students: 165 hours.
Credit points (total by discipline)	8 ECTS
Required and recommended prerequisites for joining the module	School physics
Module objectives/intended learning outcomes	The objective of the module is to understand and apply Newtonian mechanics' principles. Learning outcomes of the module are: - to understand relative motion, inertial and non inertial reference frames; - to know centre of mass and inertia tensor of mechanical systems; - to apply Newton's laws of motion and conservation principles; - to obtain parameters defining the motion of mechanical systems and their degrees of freedom.
Content	Considering the basic physical concepts and quantities. As well as the physical foundations of classical mechanics, elements of the special theory of relativity. Kinematics. Dynamics. Newton's laws. Power. Speed. Acceleration. The center of mass.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. D. Kleppner, R. Kolenkow An Introduction to Mechanics. - Cambridge University Press, 2013. - 566 p. ISBN-13: 978-0521198110. 2. Irodov I.E. Fundamental Laws Of Mechanics. - CBS PUBLISHING, 2004. - ISBN-13: 978-8123903040. 3. Davidzon M.I. Fundamentals of mechanics: a tutorial / M.I. Davidzon. - M.: Gardariki 2004.

Module 25

Module code and name	MPTH 11201 Molecular physics and thermodynamics
Semester(s), when the module is taught	2
Responsible for module person	Baratova A.A., Mauey B., Bayakhmetov O.S.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 240 hours. Lecture: 15 hours. Seminar: 30 hours. Laboratory classes: 30 hours. Independent work of students: 165 hours.
Credit points (total by discipline)	8 ECTS
Required and recommended prerequisites for joining the module	Mechanics
Module objectives/intended learning outcomes	The module objective is to develop knowledge in the basics of molecular physics and thermodynamics. Learning outcomes: to know the basics of molecular physics and thermodynamics, and methods of their study to describe the thermodynamic processes, solving physical problems and analyze the results of the experiments.
Content	Molecular physics. A model of the ideal state of a gas. Thermodynamic equilibrium. Maxwell distribution of molecular velocities. The first law of thermodynamics and its physical content. Application of the first law of thermodynamics for various processes. Adiabatic process. Polytropic process. The second law of thermodynamics. The Carnot cycle and the theorem. The entropy of an ideal gas. Statistical nature of the second law of thermodynamics. Real gases. The Van der Waals and Joule-Thomson equation. Liquids. Solid bodies. Transfer processes. Phase transformations.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. S.K. Sinha, T.K. Dey Molecular Physics: Kinetic Theory and Thermodynamics. - Alpha Science International, 2006. - 538 p. 2. W. Demtröder Molecular Physics: Theoretical Principles and Experimental Methods. - Wiley-VCH, 2005. - 484 p. ISBN-13 : 978-3527405664. 3. Irodov I.E. Problems in General Physics: Textbook. – Arihant Publications, 2020. - 403 p.

Module 26

Module code and name	VECT 22202 Basics of vector and tensor analysis
Semester(s), when the module is taught	3
Responsible for module person	Sailaubek D.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours. Lecture: 30 hours. Seminar: 30 hours. Independent work of students: 120 hours.
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	Mathematics 1, 2
Module objectives/intended learning outcomes	The module objective is to develop knowledge and competencies in the basics of vector and tensor analysis. Learning outcomes: to know the effect of the applying operator nabla and its scalar and vector products in rectilinear and curvilinear coordinate systems, as well as integrate vector functions; demonstrate a basic knowledge of (pseudo) tensors, their direct products, obedience to the rules of private, actions of affinors.
Content	Introduction to vector algebra: the concept of a scalar and vector. The law of vector transformations. Multiplication of vectors: scalar and vector, mixed and double vector products. Elements of vector analysis: gradient, divergence and curl, their consistent application. Integrating vectors: the Gauss theorem, Stokes theorem. Curvilinear orthogonal coordinate systems. Elements of tensor analysis: transfromations, tensors and pseudotensors, affinors. Introduction to the theory of elasticity, the covariant form of Maxwell's equations.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. G. B. Arfken, H.J. Weber, F. E. Harris Mathematical Methods for Physicists: A Comprehensive Guide, 7th Edition. - Academic Press, 2012. - 1220 p. 2. L. Brand Vector and Tensor Analysis. - Dover Publications, 2015. - 464 p. ISBN-13: 978-0486842837. 3. G.E. Hay Vector and Tensor Analysis. - Dover Publications, 2012. - 206 p. ISBN-13: 978-0486601090.

Module 27

Module code and name	ELMG 22209 Electricity and magnetism
Semester(s), when the module is taught	3
Responsible for module person	Baratova A.A., Giniyatova Sh.G.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours. Lecture: 30 hours. Seminar: 15 hours. Laboratory classes: 15 hours. Independent work of students: 120 hours.
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	Molecular physics
Module objectives/intended learning outcomes	The module objective is to develop basic knowledge in the field of electricity and magnetism, and research methods to explain the electromagnetic phenomena, problem solving and analysis of experimental results. Learning outcomes: to apply Coulomb's law and Gauss' law for the electrostatic force; to apply the Ampere's law to calculate magnetic fields; to know the relationship between electrostatic field and electrostatic potential; to apply the Lorentz force law for the magnetic force.
Content	The law of conservation of charge. Coulomb's law. Gauss theorem. Work in an electric field. Potential of the field. Conductors and insulators. Capacitors and their capacity. Electric field energy. Direct electric current. Electromagnetic field. Law of Joule-Lenz. Work and power. Kirchhoff's rules. Hall's effect. Dependence of conductivity on temperature. Superconductivity. A magnetic field current. The Biot-Savart's law. The Ampere's law. Lorentz's force. Motion of charged particles in electromagnetic induction. Alternating current. Maxwell's equations. Emission of electromagnetic waves.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. E. Purcell, D.J. Morin Electricity and Magnetism, 3rd Edition. - Cambridge University Press, 2013. - 853 p. ISBN-13: 978-1107014022. 2. C. McMullen Essential Calculus-based Physics Study Guide Workbook: Electricity and Magnetism (Learn Physics with Calculus Step-by-Step). - Zishka Publishing, 2017. - 572 p. 3. E.R. Peck Electricity and Magnetism. - Dover Publications, 2013. - 496 p. ISBN-13: 978-0486493497.

Module 28

Module code and name	CLME 22217 Classical Mechanics
Semester(s), when the module is taught	4
Responsible for module person	Baratova A.A., Nygymanova A.S.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Mechanics, Differential and integral equations
Module objectives/intended learning outcomes	The module objective is to develop knowledge and skills in the field of classical mechanics. Learning outcomes: to master the universal concepts and principles of theoretical mechanics; to apply the laws of equilibrium of a material point, rigid body and mechanical system for setting up and solving the equations of equilibrium and motion.
Content	The concept of force, moment of force, a point and axis, a pair of forces. Methods of transformation of coordinate systems. Equations of equilibrium of rigid bodies under the influence of different systems of forces. The center of gravity of rigid body and its coordinates. Absolute and relative motion of a point. Complex motion of a rigid body. The laws of Galileo-Newton mechanics. Differential equations of motion of a mechanical system. Amount of motion of a material point and the mechanical system. The angular momentum of a material point relatively to the center and axis. The kinetic energy of a material point and the mechanical system. The concept of the force field. D'Alembert's principle of a material point and the mechanical system. Communication and their equations. Virtual work. Generalized coordinates of the system. Differential equations of motion of a mechanical system in generalized coordinates and Lagrange equation of the second kind.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Targ S. Theoretical Mechanics: A Short Course. - Lulu.com, 2022. - 527 p. ISBN-13: 978-1387648375. 2. J.R. Taylor Classical Mechanics. - University Science Books, 2004. 3. T.W.B. Kibble, F. H. Berkshire Classical Mechanics (5th Edition). - Icp, 2004. - 500 p. ISBN-13: 978-1860944352.

Module 29

Module code and name	OPTC 22213 Optics
Semester(s), when the module is taught	4
Responsible for module person	Nygymanova A.S., Baratova A.A.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Seminar: 15 hours. Laboratory classes: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Electricity and magnetism
Module objectives/intended learning outcomes	The module objective is to develop knowledge in the basics of optics. Learning outcomes: to be familiar with the basic laws of optics; to solve the typical problems and analyze the results of experiments.
Content	Basic understanding of optics and the history of their development, electromagnetic waves, photometry, coherence, methods for producing coherent beams, interference optical phenomena multibeam interferometry method zones Fresnel diffraction, Fraunhofer diffraction, diffraction grating diffraction spatial structures, holography, the basics of geometrical optics, optical system, the interaction of electromagnetic waves with matter, light polarization, propagation of electromagnetic waves in an anisotropic field, interference of polarized rays, artificial anisotropy, rotation of the plane of polarization, dispersion of light, light absorption, light scattering, thermal radiation, the effect of light, the photoelectric effect, the propagation of light in moving media, optical lasers, quantum electronics, nonlinear optics.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. M. Born, E. Wolf Principles of Optics: 60th Anniversary Edition. - Cambridge University Press, 2020. - 992 p. ISBN-13: 978-1108477437. 2. F. L. Pedrotti, L.M. Pedrotti, L.S. Pedrotti Introduction to Optics, 3rd Edition. - Cambridge University Press, 2017. - 658 p. ISBN-13: 978-1108428262. 3. B.K. Johnson Optics and Optical Instruments: An Introduction, 3rd Revised Edition. - Dover Publications, 2011. - 256 p.

Module 30

Module code and name	ELEC 33223 Electrodynamics
Semester(s), when the module is taught	5
Responsible for module person	Sailaubek D.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Electricity and magnetism, Basics of vector and tensor analysis
Module objectives/intended learning outcomes	The objective of the module is to develop knowledge in classical electrodynamics. Learning outcomes: to explain classical electrodynamics based on Maxwell's equations including its formulation in covariant form; to solve problems involving the calculation of fields, the motion of charged particles and the production of electromagnetic waves.
Content	Vector Analysis. Electrostatics. Potentials. Electrostatic Fields in Matter. Magnetostatics. Magnetic Fields in Matter. Electrodynamics. Conservation Laws. Electromagnetic Waves. Potentials and Fields. Radiation. Electrodynamics and Relativity. Vector Calculus in Curvilinear Coordinates. Helmholtz Theorem.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. D.J. Griffiths Introduction to Electrodynamics, 4th Edition. - Cambridge University Press, 2017. - 620 p. ISBN-13: 978-1108420419. 2. A. Zangwill Modern Electrodynamics. - Cambridge University Press, 2012. - 998 p. ISBN-13: 978-0521896979. 3. A. Ricci Solutions to Problems in Jackson, Classical Electrodynamics, Third Edition Chapter 2. - 2022. - 226 p.

Module 31

Module code and name	ANPH 33224 Atomic and nuclear physics
Semester(s), when the module is taught	5
Responsible for module person	Baratova A.A.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Laboratory class: 30 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Optics
Module objectives/intended learning outcomes	The module objective is to develop knowledge in atomic and nuclear physics. Learning outcomes: to study atomic and nuclear phenomena, concepts, laws, theories; to introduce the basic methods of experimental research and control of atomic and nuclear phenomena; to introduce the basic concepts of quantum mechanics and features of the quantum mechanical approach in the study of physical phenomena.
Content	Introduction. Models of the atom. The gold foil experiment. Radioactive decay (half-life). Fission and fusion reactions. Conservation of atomic number and mass number. Products of nuclear transformation - power generation, $E = mc^2$, $P = E/t$. Properties of nuclear emissions - ionising ability, penetration ability.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. C. J. Foot Atomic Physics (Oxford Master Series in Physics). - Oxford University Press, 2005. – 346 p. ISBN-13: 978-0198506966. 2. M. Fox A Student's Guide to Atomic Physics (Student's Guides). - Cambridge University Press, 2018. - 294 p. ISBN-13: 978-1108446310. 3. F. Yang, J.H. Hamilton Modern Atomic and Nuclear Physics (Revised Edition): Problems and Solutions Manual. - World Scientific Publishing Company, 2010. - 104 p. ISBN-13: 978-9814307680.

Module 32

Module code and name	QMEC 33207 Quantum Mechanics
Semester(s), when the module is taught	6
Responsible for module person	Morzabayev A.K.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours. Lecture: 30 hours. Seminar: 30 hours. Independent work of students: 120 hours.
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	Differential and integral equations Basics of vector and tensor analysis Classical Mechanics
Module objectives/intended learning outcomes	The module objective is to give students a deep understanding of the laws of the microworld, to gain a clear understanding of the physical nature of phenomena subject to quantum laws, to learn to interpret quantum processes from a materialistic position. The learning outcomes of the module are: -apply principles of quantum mechanics to calculate observables on known wave functions; -solve time-dependent and time-independent Schrödinger equation for simple potentials; -apply the variational method, time-independent perturbation theory and time-dependent perturbation theory to solve simple problems; -combine spin and angular momenta;
Content	The module introduces Schrödinger equations with solutions in simple potentials, including harmonic oscillator, spherically symmetric potentials with hydrogen-like atoms. Axioms of quantum mechanics are introduced; matrix representation of quantum mechanics is discussed together with approximate methods (the variational method, perturbation theory, Born approximations). Program also covers spin and angular momentum representations and addition rules, and identical particles treatment.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. D.J. Griffiths, D.F. Schroeter Introduction to Quantum Mechanics. - Cambridge University Press, 2018. - 508 p. ISBN-13: 978-1107189638. 2. L. Susskind, A. Friedman Quantum Mechanics: The Theoretical Minimum. - Basic Books, 2014. - 386 p. 3. B. Zwiebach Mastering Quantum Mechanics: Essentials, Theory, and Applications. - The MIT Press, 2022. - 1104 p. ISBN-13: 978-0262046138.

Module 33

Module code and name	BAEL 43226 Basic Electronics
Semester(s), when the module is taught	7
Responsible for module person	Abuova F.U., Useinov A.B.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Laboratory classes: 30 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Electricity and magnetism
Module objectives/intended learning outcomes	The module objective is to develop knowledge and skills in basics electronics. Learning outcomes: to discuss the laws and methods of calculation of electrical and magnetic circuits, the processes occurring in them, as well as the device and the principle of operation of electrical devices; to fix the theoretical and practical training of specialists in the competent use of electrical devices in solving problems of design, installation and operation of electrical equipment and electronics.
Content	Basic theory of electrical circuits. Basic electrical quantities. Voltage, current and resistance. Ohm's law and Kirchhoff's laws. Conductors. Semiconductors. Diodes and transistors. Diodes and diode circuits. Bipolar Transistors. Some basic transistor circuits. Amplifier building blocks.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. W. Banzhaf Understanding Basic Electronics. - ARRL, the national association for Amateur Radio, 2010. - 387 p. ISBN-13: 978-0872590823. 2. G. McWhorter, A. J. Evans Basic Electronics. - Master Publishing, Inc., 2004. - 224 p. ISBN-13: 978-0945053224. 3. F. M. Mims III Getting Started in Electronics. - Master Publishing, Inc., 2020. - 128 p. ISBN-13: 978-0945053286.

Module 34

Module code and name	TMTP 44225 Theory and methods of teaching physics
Semester(s), when the module is taught	7
Responsible for module person	Nurkasymova S.N.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	General Physics Module
Module objectives/intended learning outcomes	The module objective is to introduce the modern methods of teaching physics. The learning outcomes are: −Plan and conduct various types of lessons and extracurricular activities physics; -Organize the learning activities of students, manage it and evaluate its results;
Content	Preparation of students in the process of training in the university to fulfill the professional and pedagogical activity of the teacher of physics. Methodical activity is a necessary part of the professional activity of the teacher. The theory and methodology of teaching physics are based on integrated knowledge, generalized skills and interrelationships with socio-humanitarian, psychological-pedagogical, general professional and special disciplines.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. M. Vanaja Methods of Teaching Physics. - DISCOVERY PUBLISHING HOUSE, 2020. ISBN-13: 978-8171418671. 2. J.C. Sprott Physics Demonstrations: A Sourcebook for Teachers of Physics. - University of Wisconsin Press, 2015. - 304 p. ISBN-13: 978-0299304706. 3. R. Knight Five Easy Lessons: Strategies for Successful Physics Teaching. - Pearson, 2002. - 352 p. ISBN-13: 978-0805387025.

Module 35

Module code and name	FTST 44302 Fundamentals of Thermodynamics and Statistical Physics
Semester(s), when the module is taught	7
Responsible for module person	Nygymanova A.S.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The purpose is to understand and know basics of thermodynamics and statistical physics, to apply the laws of thermodynamics in calculations and different applications. Learning outcomes are: - to have thorough knowledge on different classical and quantum mechanical distribution functions; - to apply the theory on different types of gasses: ideal classic, diatomic, quantum Fermi gasses such as quarks, electrons or baryons, quantum Bose gases such as photons, gluons or mesons; - to analyze phase diagrams, phase transitions and explain the concept of latent heat; - to apply the methods of statistical physics in other fields of physics and related fields.
Content	Statistical system as an object of study. Gibbs statistical ensemble. Distribution function. Liouville equation. Statistical averaging. The postulate of the microcanonical Gibbs distribution. Gibbs canonical distribution. The absolute temperature (zero law of thermodynamics). Microcanonical distribution in quantum statistics. Canonical and grand canonical Gibbs distribution. The method of thermodynamic potentials. Maxwell relation. Method of Jacobian. The thermodynamic theory of heat. The law of entropy. The second law of thermodynamics for non-equilibrium processes. Clausius theorem. Thermodynamics of open systems. Potential. Chemical potential. The theory of non-ideal systems. Non-ideal monatomic gas. Correlation functions. Bogolyubov equations. The pair correlation function and the equation of state of the system and their decomposition
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. F. Reif Fundamentals of Statistical and Thermal Physics. - Waveland Pr Inc, 2008. - 651 p. ISBN-13: 978-1577666127. 2. C. Heissenberg, A. Sagnotti Classical and Quantum Statistical Physics: Fundamentals and Advanced Topics. - Cambridge University Press, 2022. 3. S. Klein, G. Nellis Thermodynamics. - Cambridge University Press, 2011. - 1100 p. ISBN-13: 978-0521195706.

Module 36

Module code and name	COND 44218 Condensed Matter Physics
Semester(s), when the module is taught	8
Responsible for module person	Abuova F.U.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Laboratory classes: 30 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Fundamentals of Thermodynamics and Statistical Physics
Module objectives/intended learning outcomes	The module objective is to understand the structural, electrical, magnetic, and thermodynamic properties of the diverse phases of matter ranging from solids and liquids to superfluids and liquid crystals, to introduce the properties of these phases and the theoretical and experimental tools used to study them. Learning outcomes: to know and apply Hartree-Fock theory, to calculate properties of solids, to know and aplly Thomas-Fermi theory.
Content	Review of Free Fermi Gas electron models. Bloch's theorem (effective Hamiltonian, band structure, and group theory). The tight binding method (Brillouin zones and Wannier functions). Electron-electron interaction (Hartree Fock and DFT). Realistic calculations in solids (pseudopotential, LCAO, and plane wave). Definition of metals, insolators, and semiconductors. Hartree-Fock approximation. Hartree-Fock theory of free electrons. Thomas-Fermi theory of screening.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. S.M. Girvin, K. Yang Modern Condensed Matter Physics. - Cambridge University Press, 2019. - 714 p. ISBN-13: 978-1107137394. 2. M.P. Marder Condensed Matter Physics. - Willey, 2015. - 992 p. ISBN-13: 978-0470617984. 3. L.M. Sander Advanced Condensed Matter Physics. - Cambridge University Press, 2009. - 286 p. ISBN-13: 978-0521872904.

Module 37

Module code and name	SOLI 44212 Solid state physics
Semester(s), when the module is taught	8
Responsible for module person	Shlimas D.I.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 15 hours. Laboratory classes: 30 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Fundamentals of Thermodynamics and Statistical Physics
Module objectives/intended learning outcomes	The module objective is the formation of systematic knowledge in the field of studying the physical properties of solid-state materials and their application in various technical devices, including electronic. Learning outcomes: to explain mechanical properties of solid matter, and connect these to bond type; to explain how diffraction of electromagnetic waves on solid matter can be used to obtain lattice structure; to know the concept of phonons, and how the dispersion relationship appears for different lattice structures.
Content	Fundamentals of Solid State Physics. The structure and symmetry of solids. Band theory of semiconductors and dielectrics. Semiconductors. Specific properties of semiconductor materials. Model representations of the conductivity mechanism of intrinsic and extrinsic semiconductors. Elementary theory of electrical conductivity of semiconductors. Lattice defects. Physical phenomena in solids. Contact phenomena. Thermoelectric phenomena. Optical properties of semiconductors. Reflectance spectrum and the absorption spectrum. Self-absorption in the direct and indirect transitions. Exciton absorption. Low-dimensional systems. Nanostructured materials.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. D.W. Snoke Solid State Physics: Essential Concepts. - Cambridge University Press, 2020. - 765 p. ISBN-13: 978-1107191983. 2. F. Han Problems In Solid State Physics With Solutions. - Wspc, 2011. - 668 p. ISBN-13: 978-9814366878. 3. P. Hofmann Solid State Physics: An Introduction. - Wiley-VCH, 2022. - 288 p. ISBN-13: 978-3527414109.

Module 38

Module code and name	CHEM 33223 Chemistry
Semester(s), when the module is taught	6
Responsible for module person	Satayeva G.Ye.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours. Lecture: 30 hours. Seminar: 15 hours. Laboratory classes: 15 hours. Independent work of students: 120 hours.
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	Molecular physics
Module objectives/intended learning outcomes	The module objective is to form the basic concepts of the structure of the atom, chemical bonding, thermodynamics and kinetics of chemical reactions, to introduce the basic concepts in general chemistry. Learning outcomes: to use mathematical equations to solve chemistry problems, to demonstrate the fundamental concepts of chemistry, to demonstrate laboratory skills in chemistry.
Content	The Foundations of Chemistry. Chemical Formulas and Composition Stoichiometry. Chemical Equations and Reaction Stoichiometry. Some Types of Chemical Reactions. The Structure of Atoms. Chemical Periodicity. Chemical Bonding. Molecular Structure and Covalent Bonding Theories. Single- and Double-Displacement Reactions. Ionic Equations. Composition, Decomposition, and Combustion Reactions. Neutralization Reactions. Oxidation-Reduction Reactions
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Burrows, A. et al (2017) Chemistry 3: introducing inorganic, organic and physical chemistry, 3rd edition. Oxford: Oxford University Press. 2. Clayden, J., Greeves, N. & Warren, S. (2012) Organic chemistry, 2nd edition. Oxford: Oxford University Press. 3. R. Post, C. Snyder, C.C. Houk Chemistry: Concepts and Problems, A Self-Teaching Guide, 3rd Edition. - Jossey-Bass, 2020. - 432 p. ISBN-13: 978-1119632566.

Module 39

Module code and name	VELE 43227 Vacuum engineering and laser equipment
Semester(s), when the module is taught	7
Responsible for module person	Useinov A.B.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Electrodynamics
Module objectives/intended learning outcomes	The module objective is to develop knowledge in vacuum engineering and laser equipment. Learning outcomes: to form the basic knowledge of the vacuum techniques used in experiments in nuclear physics, to distinguish laser technologies in modern applied research in various branches of physics.
Content	Introduction to the Module. Principles and practices of vacuum science and technology. Foundation in gases and vapors under rarefied conditions. Laser Components. Laser Properties. Basic Principles. Laser Design and Fabrication. Solid State Lasers. Laser Diodes. Gas/Vapor Lasers. Chemical Lasers. Fiber and Waveguide Lasers. Dye Lasers. Other Lasers. Laser System Design. Optical Components. Optical Pulse Generation.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Kanni Raj A. Vacuum: Engineering & Applications. – CreateSpace Independent Publishing Platform, 2015. – 152 p. 2. Berman A. Vacuum Engineering Calculations, Formulas, and Solved Exercises. – Academic Press, 2012. – 257 p. 3. Guo C., Singh S.Ch. Handbook of Laser Technology and Applications. – CRC Press, 2021. – 1847 p. 4. Chambers A. Modern vacuum physics. – CRC Press, 2004. – 360 p. 5. Xinju L. Laser technology. – CRC Press, 2018. – 431 p.

Module 40

Module code and name	FLPS 33237 Foreign Language. Practice of speech and writing
Semester(s), when the module is taught	6
Responsible for module person	Tussupbekova M.Zh., Mukhtarkhanova A.M.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Seminar: 45 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Foreign Language 1,2
Module objectives/intended learning outcomes	The module objective is to master the principles of a foreign language in oral and written form and to use theoretical and practical knowledge of the studied language in solving problems in the field of professional methodology. Learning outcomes: to be able to write short and long essays on scientific topics, to know hot to write the scientific articles, to enhance academic skills in speaking.
Content	Selecting and developing appropriate topics, angles and concepts. Punctuating for respiration. Persuasion, narrative and transition techniques. Natural language. Speech introductions: attention, motivation and rapport. Speech conclusions: closure, review and rally. Preparing a speech for delivery. Notes and visuals. Academic writing. Writing the articles and papers. Academic speech.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Y. Vermani English Speaking Practice: Improve Your Speaking Skills Quickly. - Yogesh Vermani, 2015. - 220 p. 2. Strategic task to improve the quality of education, the MSC number 1 - 2003. 3. Longman Student Grammar of Spoken and Written English. 2004.

Module 41

Module code and name	FLPS 33238 Foreign Language. Practice of scientific and technical translation
Semester(s), when the module is taught	6
Responsible for module person	Tussupbekova M.Zh., Mukhtarkhanova A.M.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Seminar: 45 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Foreign Language 1,2
Module objectives/intended learning outcomes	The module objective is to develop and enhance knowledge in scientific and technical translation. Learning outcomes: to own terminology, translation skills of technical, scientific texts, business letters, contracts, skills of quick search of background information, to be able to make intelligent and translated glossary, to handle thematic vocabulary during pre-translation analysis of the original text, translate in typical scientific and technical style of foreign language syntax, perform the translation in-group.
Content	Module Introduction: introducing the module content; reviewing the syllabus. Use of monolingual and bilingual dictionaries in translation. The Fundamentals of Translation Process. Translation of journalistic texts. Translation of Evaluative Texts (argumentation). Translation of Technical Texts (Science & Technology). Translation of Legal Texts.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. J. Byrne Scientific and Technical Translation Explained: A Nuts and Bolts Guide for Beginners (Translation Practices Explained). - Routledge, 2012. - 230 p. ISBN-13: 978-1905763368. 2. M. Olohan Scientific and Technical Translation (Routledge Translation Guides). - Routledge, 2015. - 254 p. 3. A.I. Florescu-Mitchell, J.B.A. Mitchell Practical Guide To Scientific And Technical Translation, A: Publishing, Style And Terminology. - WSPC, 2022. - 188 p. ISBN-13: 978-9811243141.

Module 42

Module code and name	NRLE 44304 Nuclear reactions at low energies
Semester(s), when the module is taught	7
Responsible for module person	Mauey B.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to develop knowledge in the theory of nuclear reactions at low energies. Learning outcomes: to know the fundamental concepts pertaining to the unification of nuclear structure and reaction theory, to introduce the theoretical methods that can be used for weakly bound and unbound nuclear states.
Content	Introduction. General properties of atomic nuclei. Nuclear structure physics. Physics of nuclear reactions. Nucleon-nucleon interactions. Physical fundamentals of applied nuclear physics. Low-energy physics and elementary particles. Cosmic rays.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. V. Zagrebaev, A. Denikin, A. Karpov, Neil Rowley Heavy Ion Reactions at Low Energies (Lecture Notes in Physics Book 963). Springer, 2019. - 238 p. 2. E. Storms The science of low energy nuclear reactions World Scientific, 2007. - 342 p. 3. E. Storms The Explanation of Low Energy Nuclear Reaction: An Examination of the Relationship Between Observation and Explanation. - Infinite Energy Press, 2014. - 411 p.

Module 43

Module code and name	IBES 44305 Interaction between emission and substance
Semester(s), when the module is taught	8
Responsible for module person	Kabyshev A.M.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to provide the theoretical and experimental knowledge of the fundamental interaction processes of ionizing radiation with matter. Learnig outcomes are: -To apply the knowledge in radiation therapy, diagnostics and radiation protection. -To gain theoretical and practical knowledge on the absorption and scattering of charged and uncharged particles in matter.
Content	Introduction. A brief review of the scientific literature on the subject. Overview of the effects of radiation damage of metals and alloys. Change in mechanical properties as a result of irradiation. Parameters characterizing hardening. Hardening of mono-and polycrystalline. Law Petch Hall. Low-temperature embrittlement. Ferritic stainless steels, Rebinder effect. High-temperature radiation embrittlement and helium. The relationship of radiation-induced changes in the mechanical properties and microstructure. Some models of radiation creep. Creep rupture strength and relaxation under irradiation. Effect of the atomic displacements. Effect of hydrogen and helium, the effect of stress. Some models swelling. Ways to reduce the speed of radiation swelling materials. Relationship radiation creep and radiation swelling.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. P.G. Rancoita, C. Leroy Principles Of Radiation Interaction In Matter And Detection (4th Edition). - World Scientific, 2015. - 1344 p. 2. H. Nikjoo, S. Uehara, D. Emfietzoglou Interaction of Radiation with Matter. - CRC Press, 2016. - 364 p. 3. C-K Chris Wang Atoms, Nuclei, and Interactions of Ionizing Radiation with Matter. - Cognella Academic Publishing, 2017. - 410 p. ISBN-13: 978-1516552719.

Module 44

Module code and name	SATN 44307 The structure of atomic nucleus
Semester(s), when the module is taught	8
Responsible for module person	Kabyshev A.M.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to learn the basic properties of the nucleus of atoms, including the properties and descriptions of nucleons, their binding energy, and the basic properties of different sorts of radiation. Students will be able to describe the main properties of nucleons and nuclei: material and charge radii and distributions, binding energies, magnetic and quadrupole moments, laws of conservation of charge and mass.
Content	Statistical characteristics of atomic nuclei. Binding energy, spin and statistics of atomic nuclei. Characteristics of the ground and excited states of nuclei. Characteristics of nuclear reactions. Energy of the reaction. Reaction threshold. Differential and total cross sections. Direct nuclear reactions and their mechanisms. Application of multiple scattering theory to describe the elastic and inelastic scattering of hadrons on nuclei
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. S. Flügge Structure of Atomic Nuclei. Springer, 2014. - 576 p. 2. M. Brenner Cluster Structure of Atomic Nuclei. Research Signpost, 2010. - 164 p. 3. V.K.B. Kota, R. Sahu Structure of Medium Mass Nuclei: Deformed Shell Model and Spin-Isospin Interacting Boson Model. - CRC Press, 2016. - 304 p. ISBN-13: 978-1498753692.

Module 45

Module code and name	THNR 55305 The theory of nuclear reactions
Semester(s), when the module is taught	9
Responsible for module person	Kabyshev A.M.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	The structure of atomic nucleus
Module objectives/intended learning outcomes	The purpose of the module is to gain theoretical knowledge in area of nuclear reactions. Students will be able to describe nuclear reactions, to distinguish elastic and inelastic processes, obtain differential cross sections in different nuclear models, to use optical potential in elastic scattering, to apply kinematics and to make simple computer models of nuclear reactions.
Content	General patterns, definitions and classification of nuclear reactions. Conservation laws in nuclear reactions. The cross sections of nuclear reactions. Kinematics of nuclear reactions. Angular correlation and polarization in nuclear reactions. Mechanisms of nuclear reactions. The theory of the compound nucleus. The optical model of the nucleus. Interaction of γ-rays with the nuclei Low-energy nuclear reactions.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. L. Blokhintsev, Yu. Orlov, D. Savin Analytic and Diagram Methods in Nuclear Reaction Theory (Physics Research and Technology). Nova Science Pub Inc, 2017. - 114 p. 2. W. Tobocman Theory of Direct Nuclear Reactions. Hassell Street Press, 2021. - 122 p. 3. C. Bertulani, P. Danielewicz Introduction to Nuclear Reactions. - CRC Press. 2021. - 420 p.

Module 46

Module code and name	THAM 55320 Theory of angular momentum
Semester(s), when the module is taught	9
Responsible for module person	Morzabayev A.K.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to develop knowledge in the quantum theory of angular momentum. Learning outcomes: -Describe and analyze angular momentum states using quantum mechanically defined angular momentum operators; -Solve angular momentum eigenvalue equations; -Add angular momenta quantum mechanically; -Apply Wigner-Eckart theorem in calculations.
Content	Elements of Vectors and Tensor Theory. Angular Momentum Operators. Irreducible Tensors. Wigner D-Functions. Spherical Harmonics. Spin Functions. Tensor Spherical Harmonics. Clebsch-Gordan Coefficients and 3jm-Symbols. 6j-Symbols and the Racah Coefficients. 9j- and 12j-Symbols. Graphical Methods in Angular Momentum Theory
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. J. Schwinger On Angular Momentum. - Dover Publications, 2015. - 64 p. 2. V. Devanathan Angular momentum technics in quantum mechanics. Kluwer academic publishers, 2002. 3. C. Cohen-Tannoudji, B. Diu, F. Laloë Quantum Mechanics, Volume 2: Angular Momentum, Spin, and Approximation Methods. - Wiley-VCH, 2019. - 688 p. ISBN-13: 978-3527345540.

Module 47

Module code and name	RSSP 55314 Radiation solid state physics
Semester(s), when the module is taught	9
Responsible for module person	Usseinov A.B.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Condensed Matter Physics
Module objectives/intended learning outcomes	The objective of the module is to develop knowledge in radiation effects in solids. Learning outcomes: to gain theoretical and experimental knowledge in radiation solid state physics, to be able to describe radiation effects in solids, to introduce computer programs VASP and Crystal, to solve physical problems related to radiation effects in solids.
Content	Fundamentals of Solid State Physics. The structure and symmetry of solids. Band theory of semiconductors and dielectrics. Semiconductors. Specific properties of semiconductor materials. Model representations of the conductivity mechanism of intrinsic and extrinsic semiconductors. Elementary theory of electrical conductivity of semiconductors. Lattice defects. Physical phenomena in solids. Contact phenomena. Thermoelectric phenomena. Optical properties of semiconductors. Reflectance spectrum and the absorption spectrum. Self-absorption in the direct and indirect transitions. Exciton absorption. Low-dimensional systems. Nanostructured materials.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. G.S. Was Fundamentals of Radiation Materials Science: Metals and Alloys. - Springer, 2016. - 1029 p. ISBN-13: 978-1493934362. 2. Sh. A. Holgate Understanding Solid State Physics. - CRC Press, 2021. - 392 p. 3. K. Iniewski Advanced Materials for Radiation Detection. - Springer, 2021. - 649 p.

Module 48

Module code and name	EPPH 55323 Elementary particle physics
Semester(s), when the module is taught	9
Responsible for module person	Temerbayev A.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours. Lecture: 30 hours. Seminar: 30 hours. Independent work of students: 120 hours.
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	The structure of atomic nucleus, Condensed Matter Physics, The structure of atomic nucleus, Experimental Methods of Nuclear Physics
Module objectives/intended learning outcomes	The module objective is develop knowledge in the field of elementary particle and their properties. Learning outcomes: to familiarize with the classification of particles, with the theoretical basics of describing electromagnetic, weak and strong interactions, obtaining practical skills in calculating simple processes involving elementary particles, and to prepare students for studying specialized sections of particle physics: quantum electrodynamics, quantum chromodynamics, theory of weak interactions.
Content	An introduction to the Standard Model and its components. Antiparticles. Symmetries and conservation laws and their significance in particle physics. Hadron-hadron interactions. The quark model including spectroscopy. Quantum Chromo Dynamics (QCD). Electromagnetic interactions - form factors. The parton model and deep inelastic scattering - structure functions. Weak interactions including beta decay and Cabbibo- Kobayashi-Maskawa mixing. The unified electroweak interaction, W, Z and the Higgs boson. Beyond the Standard Model: the unification of strong and electroweak interaction, supersymmetry, neutrino oscillations.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. A. J. Larkoski Elementary Particle Physics: An Intuitive Introduction. - Cambridge University Press, 2019. - 506 p. ISBN-13: 978-1108496988. 2. D. Griffiths Introduction to Elementary Particles. - Wiley-VCH, 2008. - 470 p. ISBN-13: 978-3527406012. 3. J. Iliopoulos, T.N. Tomaras Elementary Particle Physics: The Standard Theory. - Oxford University Press, 2022. - 528 p. ISBN-13: 978-0192844217.

Module 49

Module code and name	NUAP 55324 Nuclear astrophysics
Semester(s), when the module is taught	9
Responsible for module person	Temerbayev A.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours. Lecture: 30 hours. Seminar: 30 hours. Independent work of students: 120 hours.
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	The structure of atomic nucleus, Condensed Matter Physics, The structure of atomic nucleus, Experimental Methods of Nuclear Physics
Module objectives/intended learning outcomes	The module objective is to introduce the emerging field of nuclear astrophysics, which can identify new observational signatures probing our universe. Students will be able to categorize the conditions at the core of stars and provide information of energy production from stars, nucleosynthesis and stellar evolution.
Content	Methods of astrophysical research. Function of the telescope. Planetary Astrophysics. Aberration.Reflector s. Solar physics. Stars, their characteristics and properties. Supernova remnants. Galactic astronomy. Extragalactic astronomy. Spectra of stars. Spectral classification. Hertzsprung - Russell diagram. Cosmology and cosmogony. Hubble law заңу. I cosmological solutions and Friedman.Structure of the universe.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. A.G.W. Cameron Stellar Evolution, Nuclear Astrophysics, and Nucleogenesis. - Dover Publications, 2013. - 206 p. ISBN-13: 978-0486498553. 2. Rantsini J. Space. Supernova atlas of the universe / - M., Penguin Books, 2005.-216 p. 3. T. Rauscher Essentials for Nucleosynthesis and Theoretical Nuclear Astrophysics. - Iop Publishing Ltd, 2020. - 450 p. ISBN-13: 978-0750311502.

Module 50

Module code and name	SCAT 55325 Scattering theory
Semester(s), when the module is taught	9
Responsible for module person	Sailaubek D.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	The structure of atomic nucleus, Condensed Matter Physics, The structure of atomic nucleus, Experimental Methods of Nuclear Physics
Module objectives/intended learning outcomes	The module objective is to introduce the non-relativistic quantum-mechanical description of the scattering between particles. Students will be able to obtain amplitudes of wave functions and cross sections for elastic and inelastic scattering problems.
Content	The scattering problem in quantum mechanics. The Lippmann-Schwinger equation. The Born approximation. Cross section calculation with examples. Partial waves and resonances. Discrete symmetries. Electromagnetic transitions. Two-nucleon system. Applications of quantum theory of angular momentum.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. T.Y. Wu, T. Omura Quantum Theory of Scattering. - Dover Publications, 2014. - 722 p. 2. J.R. Taylor Scattering Theory: The Quantum Theory of Nonrelativistic Collisions. - Dover Publications, 2006. - 512 p. ISBN-13: 978-0486450131. 3. Z.S. Agranovich, V. A.. Marchenko The Inverse Problem of Scattering Theory. - Dover Publications, 2020. - 304 p. ISBN-13: 978-0486842493.

Module 51

Module code and name	EDIN 24401 Educational internship
Semester(s), when the module is taught	4
Responsible for module person	Kabyshev A.M.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Practices
Workload (incl. contact hours, self-study hours)	90 hours
Credit points (total by discipline)	3 ECTS
Required and recommended prerequisites for joining the module	
Module objectives/intended learning outcomes	In the educational internship, the student gets practical skills of working with experimental data of experiments in nuclear physics, theoretical and practical knowledge about the methods of obtaining and processing this data using accelerator technology and specialized computer programs under the guidance of experienced specialists.
Content	Familiarization with radiation and technical safety Familiarization with the basic principles of the enterprise of practice, its mode of operation and routine working day The study of research equipment Gaining skills in working with a computer program LISE to study the kinetics of nuclear reactions Gaining skills in working with a computer program MAESTRO for receiving and processing the spectra of nuclear reactions Gaining skills in the computer program ORIGIN for post-processing of the spectra of nuclear reactions and obtain experimental angular dependence of the cross section in tabular and graphical form
Examination forms	Report
Study and examination requirements	Timely completion and delivery of tasks, independent work of students, attendance of intermediate control, delivery of tasks of the final report
Technical, multimedia tools and software	LISE, MAESTRO, Origin Pro programs
Reading list	Literature is selected by the head of practice

Module 52

Module code and name	PBNM 34207 Physical bases of nuclear medicine
Semester(s), when the module is taught	5
Responsible for module person	Useinov A.B.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Electricity and magnetism
Module objectives/intended learning outcomes	The module objective is to introduce the features and principles of nuclear medicine. Students study and master the basic concepts and problems of the use of radionuclides and related ionizing radiation for diagnosis, therapy and surgery in medicine.
Content	Basic concepts of nuclear medicine. Introduction to Radiography. Projects in Nuclear Medicine Technology. Production of radionuclides for medical purposes. Applications of Radionuclides. Radiation Protection in Nuclear Medicine. Synthesis and quality control of radiopharmaceuticals. The device and principle of operation of the PET scanner. Radionuclide therapy.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Joao Jose De Lima Nuclear Medicine Physics. CRC Press, 2018. - 524 p. ISBN 9781138374966. 2. Troy Farncombe, Krzysztof Iniewski Medical Imaging Technology and Applications. CRC Press, 2017. – 740 p. ISBN 9781138072282. 3. P. Bennett MD Diagnostic Imaging: Nuclear Medicine. - Elsevier, 2020. - 700 p. ISBN-13: 978-0323765305.

Module 53

Module code and name	UNFM 34208 The use of nuclear facilities in medicine
Semester(s), when the module is taught	5
Responsible for module person	Kabyshev A.M.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Electricity and magnetism
Module objectives/intended learning outcomes	The module objective is to develop theoretical and practical knowledge of the operation of nuclear facilities, accelerators and detectors. Learning outcomes: to know the the following methods of radiation diagnostics: computer X-ray diagnostics, positron emission tomography, scintigraphy, etc; to know the prospects for the use of radionuclides for therapeutic purposes, and ionizing radiation for surgical purposes.
Content	The module deals with the physical and technical principles of the nuclear medical equipment. The module also provides an advanced study in the fields of radiation physics and radiation protection in nuclear medicine. Further, the production and absorption mechanisms of the radiopharmaceuticals will be treated. The student will also be trained to independently, complete, calculate dose, and inject radiopharmaceuticals, and carry out commonly occurring nuclear medical examinations.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Simon R. Cherry, James A. Sorenson, Michael E. Phelps Physics in Nuclear Medicine 4th Edition. Saunders, 2012. - 544 p. ISBN: 9781416051985. 2. Paganetti H. Proton Therapy Physics, CRC Press, 2012, P. 651. 3. P. Shackett Nuclear Medicine Technology: Procedures and Quick Reference. - LWW, 2019. - 728 p. ISBN-13: 978-1975119836.

Module 54

Module code and name	BPHN 33236 Basics physics of nanosystems
Semester(s), when the module is taught	5
Responsible for module person	Abuova F.U.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Laboratory classes: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Electricity and magnetism
Module objectives/intended learning outcomes	The module objective is to give students an idea of the main directions of development of microtechnology, modern nanotechnology, quantum devices and devices, the creation of the element base of nanoelectronics, and methods and materials of nanotechnology. Students should know how to explain the properties of nanoscale objects and effective methods of control parameters, the creation of nanoscale elements and structures, the main technological processes.
Content	The most important discoveries in the physics of nanosystems. Classification of nanomaterials Features of interactions on nanoscale. Nanoparticles, clusters. Nanolayer structures. Interactions at the nanoscale. Electron microscopes, scanning tunneling microscope. Atomic force microscope. Near-field optical microscope. Nanoelectronics.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Nanotechnology in the next decade. Forecast research directions. Collected under red. M.K.Roko, R.S.Uilyamsa and P.Alivisatosa, Wiley, New York, 2002 2. Ch.Pul, F.Ouens, Nanotechnology (2nd ed.), M., Technosphere, 2005, 334 pp. 3. N.Koboyasi, Introduction to nanotechnology, M., BINOM. Knowledge Laboratory, 2005. 4. A.I.Gusev, nanomaterials, nanostructures, nanotechnology, M., FIZMATLIT, 2005, 416. V.Mironov "Fundamentals of the scanning probe microscopy," M. Technosphere, 2005, 144.

Module 55

Module code and name	EMNP 44309 Experimental Methods of Nuclear Physics
Semester(s), when the module is taught	7
Responsible for module person	Kabyshev A.M.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to gain knowledge about experimental methods used in nuclear physics. After this module, students will be able to describe the main experimental methods in nuclear physics, to estimate energy losses in nuclear reactions, to gain knowledge about experimental obtaining of cross sections, to work with experimental databases of nuclear reactions like NRV JINR.
Content	Basic understanding of nuclear interactions. Basic definitions of the structural characteristics of the nuclei, the structure of atomic nuclei. Their connection with the nuclear interaction, and experimental methods for measuring the reaction cross sections. The interaction of ionizing radiation with matter and their registration. Neutron absorption features and their detection. Detectors and particle counters. Principles of their actions and characteristics. Modern detector for high-energy detector ATLAS. Measurement error, the experimental basis for error values and parameters in nuclear physics
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. R.N. Cahn, G. Goldhaber The Experimental Foundations of Particle Physics. - Cambridge University Press, 2009. - 566 p. ISBN-13: 978-0521521475. 2. S. Tavernier Experimental Techniques in Nuclear and Particle Physics. - Springer, 2010. - 508 p. 3. H.S. Hans Nuclear Physics: Experimental and Theoretical. - New Age International Publisher, 2013. ISBN-13: 978-8122431414.

Module 56

Module code and name	ACCE 44308 Accelerator Physics
Semester(s), when the module is taught	7
Responsible for module person	Kabdrakhimova G.D.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to present the basic knowledge of particle accelerator physics, and to form qualitative representation and understanding of the processes occurring in accelerators. Learning outcomes: to increase knowledge of the interaction of charged particles in an electromagnetic field, to introduce the principle of operation of existing accelerators and an alternative acceleration mechanism.
Content	Linear accelerators. The main types of linear accelerators. Stability of orbits of the accelerated particles. Phase oscillations in linear resonance accelerator. Circular accelerators. Cyclotron. Betatron. Microtron. Synchrotron. Synchrophasotron. The motion of particles in periodic structures. Resonances. Synchrotron radiation. Quantum fluctuations of radiation. Effect of the space charge field. Colliding particle beams and storage rings. Luminosity. Electronic methods and stochastic cooling. Colliders. Large Hadron Collider.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. H. Wiedemann Particle Accelerator Physics. - Springer, 2015. - 1586 p. 2. A. W.Chao, K. H. Mess, M. Tigner, F. Zimmermann. Handbook of Accelerator Physics and Engineering, Second Edition. 2013 by World Scientific Publishing Co. Pte. Ltd. 3. J.C. Philip Particle Accelerators: Physics Made Simple. - Philip Communications, 2016. - 29 p.

Module 57

Module code and name	NEUT 44309 Neutron physics
Semester(s), when the module is taught	7
Responsible for module person	Baratova A.A.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is the study of neutrons, their properties and structure. The module provides students with ideas about physical phenomena in reactors, methods of their theoretical understanding and experimental observation, scales of physical quantities of neutron physics
Content	Radioactive decay law, neutron distribution in energy, space, time, depletion calculations, reactivity balance, and reactivity coefficients, neutron diffusion equation, neutrons point kinetics equation, Doppler broadening, neutron feedback.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. P. Reuss Neutron Physics. - EDP Sciences, 2008. - 669 p. ISBN-13: 978-2759800414. 2. J. Byrne Neutrons, Nuclei and Matter: An Exploration of the Physics of Slow Neutrons. - Dover Publications, 2013. - 799 p. 3. V. Valkovic 14 MeV Neutrons: Physics and Applications. - CRC Press, 2015. - 516 p.

Module 58

Module code and name	RADS 44313 Radiation safety
Semester(s), when the module is taught	8
Responsible for module person	Kabdrakhimova G.D.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to describe fundamentals of radiation safety. Students will know how to provide safe work with equipment used in nuclear facilities like X-rays devices, accelerators, nuclear reactors and etc.
Content	Introduction. Radiation - Basic Concepts. Health Effects of Ionising Radiation. Protection from External Radiation. Protection from internal radiation. Safe Use of X-Rays. Radiation Safety and Emergency Procedures. Laser Cutter Training. General Laser Safety Training.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Haydee Domenech Radiation Safety: Management and Programs. Springer International Publishing Switzerland, 2017. - 332 p. ISBN 978-3-319-42671-6. 2. Jason S. Ballard Radiation Safety. Linn Benton Community College, 2020. ISBN 13: 9781636350219ю 3. G.B. Saha Radiation Safety in Nuclear Medicine: A Practical, Concise Guide. - Springer, 2019. - 318 p.

Module 59

Module code and name	PDOS 44312 Principles of dosimetry
Semester(s), when the module is taught	8
Responsible for module person	Zhumadilov K.Sh.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to develop an intuition about dosimetry from basic principles, as a strong foundation before studying the applications of radiation dosimetry in the other courses for radiotherapy, nuclear medicine, and radiology. Students will acquire the theoretical and experimental principles of radiation dosimetry.
Content	The study of the fundamentals of ionizing radiation dosimetry, the general concept of radioactivity, familiarization with the principles of operation of dosimetry units. Acquaintance with the basic concepts of radioactivity, current problems of the industry.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Greening, J.R., Green, S., Charles, M.W. (2010). Fundamentals of radiation dosimetry (3rd ed.). London: Taylor & Francis. 2. IAEA. (2013). Guidelines for development, validation and routine control of industrial radiation processes. Vienna: IAEA. (IAEA Radiation Technology Series No. 4). 3. W. Amestoy Review of Medical Dosimetry: A Study Guide. - Springer, 2015. - 885 p.

Module 60

Module code and name	ITIN 44402 Industrial internship
Semester(s), when the module is taught	8
Responsible for module person	Thesis supervisors
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Practices
Workload (incl. contact hours, self-study hours)	90 hours
Credit points (total by discipline)	3 ECTS
Required and recommended prerequisites for joining the module	Compulsory components of the theoretical module
Module objectives/intended learning outcomes	Industrial-teaching internship is designed to reinforce knowledge and skills acquired in the module of studying the discipline "Nuclear Physics", as well as for the development of modern methods of theoretical and experimental nuclear physics, non-curriculum subjects "Nuclear Physics".
Content	Structure of DC-60 Cyclotron. Channels of DC-60. Applications of DC-60 and scientific investigations.
Examination forms	Report
Study and examination requirements	Timely completion and delivery of tasks, independent work of students, attendance of intermediate control, delivery of tasks of the final report
Technical, multimedia tools and software	DC-60 Cyclotron
Reading list	Reading list is selected by the head of the practice

Module 61

Module code and name	TEPR 44403 Teaching internship
Semester(s), when the module is taught	8
Responsible for module person	Kabyshev A.M.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Practices
Workload (incl. contact hours, self-study hours)	60 hours
Credit points (total by discipline)	2 ECTS
Required and recommended prerequisites for joining the module	Compulsory components of the theoretical module
Module objectives/intended learning outcomes	To develop the pedagogical and educational skills and abilities of students, as well as to practically consolidate the material covered in basic and specialized subjects.
Content	The student independently produces the content of classes by the subject "Physics" in a secondary school.
Examination forms	Report
Study and examination requirements	Delivery of the final report
Technical, multimedia tools and software	Presentation projector
Reading list	Literature is chosen by the student during the period of teaching practice in secondary school

Module 62

Module code and name	NRNP 55306 Nuclear reactors and nuclear power
Semester(s), when the module is taught	9
Responsible for module person	Giniyatova Sh.G.
Language of study	Kazakh/Russian
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Experimental Methods of Nuclear Physics
Module objectives/intended learning outcomes	The module objective is to introduce to the theory and applications of nuclear reactors. Learning outcomes of this module are: -express the basic concepts of nuclear physics; -express the alpha, beta, gamma decays; -explain nuclear fission; -describe basic elements of nuclear reactor; -calculate nuclear binding energy and nuclear masses.
Content	Introduction. Nuclear reactors, energy development using them. Fundamentals of nuclear power. Energy of the atomic nucleus. Fusion reaction and fission reaction. Their advantages and disadvantages in Semesters of getting and electricity. The weakening of the neutron flux material. Neutron moderation. Choice provided slowdown. Different types of moderators. Moderator and coolant. Major nuclear power reactors used. Characteristics of the reactor core. Fuel rods. and cooling structure. Open fuel cycle. Closed cycle. Reproduction of fuel in a nuclear reactor. Breeder reactors. Ways to improve safety of nuclear power plants. Selecting a location Building nuclear power plants. Basics of technical and economic calculation nuclear power plant.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. C. Tucker How to Drive a Nuclear Reactor. Springer, 2020. - 281 p. 2. T. Schulenberg The fourth generation of nuclear reactors: Fundamentals, Types, and Benefits Explained. Springer, 2022. - 198 p. 3. Vaidyanathan G. Nuclear Reactor Engineering (Principles And Concepts). S Chand & company, 2013. - 248 p.

Module 63

Module code and name	NDEC 55307 Nuclear Radiation Detectors
Semester(s), when the module is taught	9
Responsible for module person	Temerbayev A.A.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (university component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Experimental Methods of Nuclear Physics
Module objectives/intended learning outcomes	The module objective is to develop knowledge in nuclear radiation detectors and to introduce the basic concepts of particles detection. Learning outcomes: to describe the physical mechanisms for detection of gamma and neutron radiation; to identify and explain the general operation of gas-filled, scintillation, and semiconductor detectors.
Content	The interaction of charged particles with matter. Hadron interaction with matter. Interaction of X-ray and gamma-radiation with matter. The interaction of neutrinos with matter. Classification methods for detecting radiation and radiation detectors. Crystalline semiconductor detectors and scintillation detection methods. Cerenkov radiation detectors. Track detectors. Systematization of methods for detecting radiation and various types of detectors.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. A.K. Batra Advanced Nuclear Radiation Detectors: Materials, Processing, Properties And Applications. Iop Publishing Ltd, 2021 - 225 p. 2. L. Cerrito Radiation and Detectors: Introduction to the Physics of Radiation and Detection Devices. - Springer, 2017. - 374 p. 3. S. Awadalla Solid-State Radiation Detectors: Technology and Applications (Devices, Circuits, and Systems). - CRC Press, 2017. - 384 p.

Module 64

Module code and name	HION 55313 Heavy-Ion Physics
Semester(s), when the module is taught	9
Responsible for module person	Kabdrakhimova G.D.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The objective of the module is to convey an understanding of the properties of heavy ions. The student should have: -an thorough overview over heavy ion physics at low, medium and high energies; -a broad basis for further experimental and theoretical studies.
Content	Features of the interaction of heavy ions with nuclei classification reactions. Coulomb excitation of nuclear levels. Elastic scattering of heavy ions on nuclei. Of the direct interaction. Fusion reaction and fission. Beams of radioactive nuclei. Nuclear Astrophysics. Applied Nuclear Physics. Nuclear Methods and Astrophysics.Synthesis of new elements. Development of accelerator technology heavy ions. Cyclotron, DC -60, synchrotron.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. J. Bartke Introduction to Relativistic Heavy Ion Physics. World Scientific Publishing Company, 2008. - 240 p. 2. P. Sigmund Stopping of Heavy Ions: A Theoretical Approach. Springer, 2004. – 178 p. 3. G. F. Knoll. Radiation Detection and Measurement. 3rd edition (2000).

Module 65

Module code and name	EXNU 55314 Exotic nuclei
Semester(s), when the module is taught	9
Responsible for module person	Baratova A.A.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Quantum Mechanics
Module objectives/intended learning outcomes	The module objective is to examine the main properties and characteristics of exotic nuclei with further application in experimental activity. Student will acquire theoretical and experimental knowledge of exotic nuclei structure and properties.
Content	Nuclear stability limits. Mass and binding energy of nuclei near the boundaries of neutron stability. Features of filling energy levels. Change in the shape of the nuclei during approaching the stability limits. Systematics of nuclear radii of light nuclei. Neutron halo. Fission reactions. Reactions of fragmentation of the target nucleus. Bombing ion fragmentation reactions. Reactions with heavy ions, accompanied by the emission of fast particles. Recharge reactions. Features of transfer reactions for spectroscopy of light exotic nuclei. Deep inelastic transfer reactions, quasi fission. Spectroscopy on beams of radioactive nuclei. Distribution of nucleon densities in exotic nuclei. Momentum distribution of weakly coupled nuclei. Methods for studying the structure of neutron-rich nuclei. Methods for obtaining radioactive beams.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. Y. Suzuki, K. Yabana, R. G. Lovas, K. Varga Structure and Reactions of Light Exotic Nuclei. - CRC Press, 2003. - 608 p. 2. Y. E. Penionzhkevich, R. Kalpakchieva Light Exotic Nuclei Near The Boundary Of Neutron Stability. - World Scientific, 2021. - 488 p. 3. J. Al-Khalili Halo Nuclei. - Iop Concise Physics, 2017. - 65 p. ISBN-13: 978-1643277950.

Module 66

Module code and name	APPL 55326 Physical Principles of Applied Nuclear Physics
Semester(s), when the module is taught	9
Responsible for module person	Shlimas D.I.
Language of study	Kazakh/Russian/English
Relationship with curriculum (cycle, component)	Profile (elective component)
Teaching methods	Group work, discussions, brainstorming, solution of non-trivial problems, presentations of problematic lectures.
Workload (incl. contact hours, self-study hours)	Total workload: 150 hours. Lecture: 30 hours. Seminar: 15 hours. Independent work of students: 105 hours.
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the module	Experimental Methods of Nuclear Physics
Module objectives/intended learning outcomes	The module objective is to introduce the physical principles of applied nuclear physics. Learning outcomes: to know the application of radioactive isotopes in areas such as nuclear medicine, nuclear energy, geochronology, and batteries based on them, and mineral exploration; to distinguish applied methods of nuclear physics.
Content	Applied nuclear physics is the study and application of the properties of atomic nuclei. This is a wide field. Examples of applications range from energy production in nuclear power plants to the measurements of extremely small quantities of different isotopes.
Examination forms	Oral exam
Study and examination requirements	Visiting the classes, the classroom activity, timely execution and submission of tasks, independent work of students; midterm submission, submission of tasks of final examination
Technical, multimedia tools and software	Online videos, presentations
Reading list	1. K. Heyde Basic Ideas and Concepts in Nuclear Physics: An Introductory Approach, Third Edition (Fundamental & Applied Nuclear Physics). - CRC Press, 2020. - 360 p. 2. N. Crawford Nuclear Physics: Applied Principles. - NY RESEARCH PRESS, 2022. - 224 p. ISBN-13: 978-1632388940. 3. M.S.Sharma Applied Nuclear Physics. - Swastik Publications, 2014. ISBN-13: 978-9383762033.

Module 67

Module code and name	ININ 55327 Industrial internship
Semester(s), when the module is taught	10
Responsible for module person	Thesis supervisors
Language of study	Kazakh
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Practices
Workload (incl. contact hours, self-study hours)	60 hours.
Credit points (total by discipline)	2 ECTS
Required and recommended prerequisites for joining the module	Compulsory components of the theoretical module
Module objectives/intended learning outcomes	Students will be able to form and consolidate professional knowledge and skills obtained as a result of theoretical training, to present known and own scientific results in the form of reports, presentations, etc. for scientific and professional activities.
Content	Industrial internship is designed to reinforce knowledge and skills acquired in the basic courses of nuclear physics, to apply theoretical and experimental knowledge in practice.
Examination forms	Report
Study and examination requirements	Timely completion and delivery of tasks, independent work of students, attendance of intermediate control, delivery of tasks of the final report
Technical, multimedia tools and software	DC-60 Cyclotron
Reading list	Reading list is selected by the supervisors of students

Module 68

Module code and name	ITIN 55328 Industrial-teaching internship
Semester(s), when the module is taught	10
Responsible for module person	Thesis supervisors
Language of study	Kazakh
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Practices
Workload (incl. contact hours, self-study hours)	120 hours
Credit points (total by discipline)	4 ECTS
Required and recommended prerequisites for joining the module	Compulsory components of the theoretical module
Module objectives/intended learning outcomes	Students will be able to: -give lessons at school; -use the gathered theoretical and experimental knowledge in pedagogical activities; -conduct laboratory experiments.
Content	Industrial-teaching internship is designed to consolidate pedagogical knowledge and skills in the field of nuclear and general physics
Examination forms	Report
Study and examination requirements	Timely completion and delivery of tasks, independent work of students, attendance of intermediate control, delivery of tasks of the final report
Technical, multimedia tools and software	Presentation projector
Reading list	The list of references is selected by the supervisors of students

Module 69

Module code and name	UGPL 55329 Undergraduate internship
Semester(s), when the module is taught	10
Responsible for module person	Thesis supervisors
Language of study	Kazakh
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Practices
Workload (incl. contact hours, self-study hours)	180 hours
Credit points (total by discipline)	6 ECTS
Required and recommended prerequisites for joining the module	Compulsory components of the theoretical module
Module objectives/intended learning outcomes	The purpose is to teach students how to write diploma projects, articles, scientific papers, to conduct experiments and design computer programs for calculations in nuclear physics.
Content	Undergraduate internship is designed to write students' theses
Examination forms	Report
Study and examination requirements	Timely completion and delivery of tasks, independent work of students, attendance of intermediate control, delivery of tasks of the final report
Technical, multimedia tools and software	Presentation projector
Reading list	The list of references is selected by supervisors

Module 70

Module code and name	MFA 52010 Module of final assessment
Semester(s), when the module is taught	10
Responsible for module person	Thesis supervisors
Language of study	Kazakh
Relationship with curriculum (cycle, component)	Final assessment
Teaching methods	General theoretical and experimental methods of nuclear physics
Workload (incl. contact hours, self-study hours)	360 hours
Credit points (total by discipline)	12 ECTS
Required and recommended prerequisites for joining the module	All completed modules for the entire time of the student's study
Module objectives/intended learning outcomes	Students will be able to present their diploma projects as well as scientific achievements and results.
Content	Writing and defending a thesis, graduation project or preparing and passing a comprehensive exam
Examination forms	Diploma project
Study and examination requirements	Timely completion and delivery of tasks, independent work of students, attendance of intermediate control, delivery of tasks of the final report
Technical, multimedia tools and software	Presentation projector
Reading list	The list of references is selected by supervisors

Considered and approved at the meeting of the Department of Nuclear Physics, New Materials and Technologies
date 12.12.2022 Record № 5

Zhumadilov K.Sh. _____ 12.12.2022
(Name) (signature) (date)