NJSC "L. N. GUMILYOV EURASIAN NATIONAL UNIVERSITY"

Modular guide
according to the educational program
7M05305 Nuclear physics (master's degree)

Astana
2022

Module 1

Module code and name	EDUC 52103 Higher Education Pedagogy
Semester(s), when the module is taught	1
Responsible for module person	Kalkeeva K.R.
Language of study	English, Russian, Kazakh
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Traditional. Active and interactive teaching methods
Workload (incl. contact hours, self-study hours)	Total workload: 120 hours. Lectures: 15 hours, practical: 22 hours, independent work of students: 83 hours.
Credit points (total by discipline)	4 ECTS
Required and recommended prerequisites for joining the module	Methods of studying private methods, Teaching technologies at the university.
Module objectives/intended learning outcomes	The development of professional and pedagogical thinking of teachers, the formation of scientific and pedagogical knowledge and skills necessary both for teaching activities and for improving general professional competence and pedagogical culture.
Content	The proposed course is aimed at familiarizing undergraduates with scientific and pedagogical approaches to the organization of the pedagogical process, as well as with the principles of pedagogical activity carried out in the system of vocational education. The sphere of professional pedagogical activity of the teacher is: - higher educational institutions; - colleges and other educational institutions; - organizations and enterprises whose activities are related to various aspects of teaching. The presented discipline involves the creation of pedagogical conditions that ensure the development of the pedagogical position of masters, the formation of which determines the manifestation of the subjective characteristics of the teacher's personality in the system of vocational education.
Examination forms	Matrix test
Study and examination requirements	Visit to the MOOC platform. Studying the materials proposed on the basis of MOOC and PLATONUS, timely completion of tasks and, according to the test schedule, pass tests for the main course and individual work of students.
Technical, multimedia tools and software	Recording video lectures accompanied by slides and films. Study and feedback is carried out on the basis of MOOC and PLATONUS.
Reading list	1.Ahmetova G.K., Isaeva Z.A. Pedagogika: Uchebnik dlya magistratury universitetov. – Almaty: Қazaқ universiteti, 2018 – 328 s. 2.Pedagogicheskie tekhnologii: uchebnoe posobie dlya studentov pedagogicheskih special'nostej / pod red. V. S. Kukushina. — Rostov n/D: Mart, 2017. — 320 s. 3.Pedagogika vysshej shkoly: Uchebnik / Okolelov O.P. – M.:NIC INFRA-M, 2017. – 176 s. 4.Pedagogika vysshej shkoly: Uchebnik / K.R.Kalkeeva i dr – Astana-TOO «Master PO», 2017. – 253 s.

Module 2

Module code and name	PSYC 52104 Management Psychology
Semester(s), when the module is taught	1
Responsible for module person	Mambetalina A.S.
Language of study	English, Russian, Kazakh
Relationship with curriculum (cycle, component)	Basic (university 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: 120 hours. Lectures: 15 hours, practical: 23 hours, independent work of students: 82 hours.
Credit points (total by discipline)	4ECTS
Required and recommended prerequisites for joining the module	Psychology, Rukhani zhangyru
Module objectives/intended learning outcomes	Objectives: to train Master's degree students in management fundamentals that ensure the preservation of a certain structure, organized systems; maintaining the mode of management activities, the implementation of the program and management goals in professional activities. Intended learning outcomes: Know: the essence of the subject psychology of management; basic theories and concepts of management psychology in modern domestic and foreign science; methodological and technological features of management in the professional sphere. Skills: be able to: analyze the processes of management activities; identify psychological control schemes; develop management schemes taking into account psychological patterns; determine the features of psychological interaction in management Own: modern methods of socio-psychological analysis and diagnosis of the content and forms of management activities; methods of implementation of the main management approaches in the field of public procurement.
Content	Introduction to the psychology of management. Leader personality. Management styles, delegation and business career of the leader. Psychology of staff motivation. Socialization of personality as a social phenomenon. Characteristics of the process of adaptation of the subordinate to the conditions of the organization. The system of regulation of behavior and activity of the individual in the organization. Communication as a social phenomenon. Features of managerial communication. Communication between the leader and subordinates as the exchange of information, interaction and influence. Problems of interpersonal perception in managerial communication. Features of communication of the leader in a modern organization. Social organization as an object of management. Psychology of conflict management in the activities of the leader. Social intelligence in the activities of the leader. Leader health. Prevention and overcoming stresses and life crises.
Examination forms	Matrix test
Study and examination requirements	It is necessary to participate in all types of control: current, intermediate, final, control of students' independent work. The discipline determines the final grade, which consists of the results of the rating control and the exam, while 60% are rating control, 40% are the result of the exam. The exam must score at least 50% to successfully complete the course.
Technical, multimedia tools and software	Recording video lectures accompanied by slides and films. Study and feedback is carried out on the basis of MOOC and PLATONUS.

Reading list	1. Bazarov, T.YU. Psihologiya upravleniya personalom: Uchebnik i praktikum dlya akademicheskogo bakalavriata / T.YU. Bazarov. - Lyubercy: YUrajt, 2016. - 381 c. 2. Kozlov, V.V. Psihologiya upravleniya: Uchebnik / V.V. Kozlov. - M.: Akademiya, 2016. - 240 c. 3. Mal'ceva YU. A, YAcenko O. YU. Psihologiya upravleniya. Ekaterinburg : Izd-vo Ural. un-ta, 2016.— 92 s. 4.Litvak, M.E. Komandovat' ili podchinyat'sya? Psihologiya upravleniya / M.E. Litvak. - Rn/D: Feniks, 2018. - 384 c. 5. Konovalenko, V. A. Psihologiya upravleniya personalom: uchebnik dlya akademicheskogo bakalavriata / V. A. Konovalenko, M. YU. Konovalenko, A. A. Solomatin. — M.: Izdatel'stvo YUrajt, 2015. — 477 s. — (Seriya : Bakalavr. Akademicheskij kurs). 6. Bazarov T.YU. Psihologiya upravleniya personalom: uchebnik i praktikum dlya akademicheskogo bakalavriata.2015, Izdatel'stvo YUrajt M. - 381 s. 7. Kozlov, V.V. Psihologiya upravleniya / V.V. Kozlov. - M.: Academia, 2017. - 48 c. 8. Konovalenko, V.A. Psihologiya upravleniya personalom: Uchebnik dlya akademicheskogo bakalavriata / V.A. Konovalenko, M.YU. Konovalenko, A.A. Solomatin. - Lyubercy: YUrajt, 2016. - 477 c. 9. Korolev, L.M. Psihologiya upravleniya: Uchebnoe posobie / L.M. Korolev. - M.: Dashkov i K, 2016. - 188 c.

Module 3

Module code and name	EDUC 52405 Master Training Methodology
Semester(s) in which this module is taught	1, 2, 3, 4
Person responsible for the module	A.A. Temerbaev
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	—
Teaching methods	Practice oriented
Workload (incl. contact hours, self study hours)	Total workload: 690 hours
Amount of credits (total over the module)	24 ECTS
Required and recommended prerequisites for attaching to the module	—
Module objectives / intended learning outcomes	To prepare the undergraduate for independent research work and for conducting research as part of a team. / Complete a master's thesis.
Course content	Research work of a master student, including an internship and a master's thesis
Exam Forms	Report
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale.
Technical, multimedia tools and software	Multimedia
Bibliography	1 Академиялық сауаттылықтың теориялық және практикалық негіздері : оқу құралы / Б.Б. Динаева, С.М. Сапина. - Толық. 2-бас. - Нұр-Сұлтан : [б. и.], 2020. - 199, [1] б. - Библиогр.: б. 195. - ISBN 978-601-7538-27-9. - Текст : электронный. 2 Основы научно-педагогических исследований : учебное пособие : курс лекций для бакалавриата / Мынбаева Айгеним Казыевна; Казахский национальный университет им. аль-Фараби. - Алматы : Қазақ университеті, 2013. - 220 с. - Библиогр.: с. 218-219. - ISBN 978-601-04-0318-5. 3 Диссертация и ученая степень : пособие для соискателей / Б.А. Райзберг. - 3-е изд., доп. - Москва : ИНФРА-М, 2003. - 409, [2] с.

Module 4

Module code and name	NCPh 53111 Nuclear fission
Semester(s) in which this module is taught	1
Person responsible for the module	А.К.Морзабаев
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Basic (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours. Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Atomic and nuclear physics. 2. Introduction to the physics of the atomic nucleus. 3. Physics of atoms and atomic phenomena.
Module objectives / intended learning outcomes	To give information about the mechanisms of fission of atomic nuclei, to consider the principles of their fission on the basis of demonstration models of the uranium nucleus, to acquaint students with the fundamental processes of nuclear chain reactions. / To form basic knowledge about the mechanisms of nuclear fission of atoms of radioactive elements, to have the skills to use various modern methods to describe the chain reaction of nuclear fission, to have knowledge about spontaneous fission, about the mechanisms of nuclear fission.
Course content	The study of this module by students allows us to give the concepts of elementary theory of fission, spontaneous fission, mechanisms of fission of uranium nuclei under the action of neutrons, chain reactions of fission, the problems of uranium enrichment, neutron deceleration during passage through the substance, scientific and technical use of the most important subatomic phenomena in the nuclear industry, nuclear reaction energy, nuclear binding energy, arbitrary and forced nuclear fission, etc.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Schunck N. The theory of Nuclear Fission. - LLNL-JRNL-830603.- 2022. - 106 p. 2 M. Albertsson, B. G. Carlsson, T. Dossing, P. Moller, J. Randrup, S. ¨ Aberg, Correlation studies of fission- fragment neutron multiplicities, Phys. Rev. C 103 (1) (2021) 014609. 3 I. Stetcu, A. E. Lovell, P. Talou, T. Kawano, S. Marin, S. A. Pozzi, A. Bulgac, Angular Momentum Removal by Neutron and Gamma-Ray Emissions during Fission Fragment Decays, Phys. Rev. Lett. 127 (22) (2021) 222502.

Module 5

Module code and name	NCPh 53112 Alpha-, beta- and gamma- decays of nuclei
Semester(s) in which this module is taught	1
Person responsible for the module	A.M.Zikirina
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Basic (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours. Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Interaction of ionizing radiation with matter. 2. Nuclear radiation detectors. 3. Experimental methods of nuclear physics.
Module objectives / intended learning outcomes	To form the ability of students to study processes under the influence of alpha-, beta-, gamma-decay of nuclei. / Be able to classify the type of nuclear decay, choose modern methods for calculating long-term characteristics, have skills in using basic experimental data on nuclear decay in the nuclear industry, dosimetry, labor protection and human life safety.
Course content	The study of this course involves consideration of different types of nuclear decay, laws and methods of their formation, deformations and decay barriers, consideration of the tunneling effect in alpha decay.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Krappe H., Pomorscki K. The theory of Nuclear Fission. -Springer. -2012.-320 p. 2 Blin-Stoyle R. J. Alpha, beta and gamma decay**.** - Springer. -2021.-P.96-106. 3 A. Algora, J. L. Tain, B. Rubio, M. Fallo, Beta-decay studies for applied and basic nuclear physics. - EPJ manuscript. -26 p.

Module 6

Module code and name	NCPh 53113 Neutrons and gamma quanta
Semester(s) in which this module is taught	1
Person responsible for the module	N. Amangeldy
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Basic (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Neutron physics. 2. Atomic and nuclear physics. 3. Physics of accelerators.
Module objectives / intended learning outcomes	To form knowledge in the field of physics of neutrons and gamma quanta, to give basic ideas, as well as the opportunity to apply theory, calculate and evaluate the basic mechanisms of nuclear reactions with neutrons and gamma quanta in practice conducted in research institutes. / Be able to determine the types of interaction of neutrons with matter, be able to choose methods for measuring neutron radiation and build protection against it, calculate cross sections of neutron interaction in different fields of natural science, have the skills to measure neutron and gamma radiation spectra under different experimental conditions.
Course content	The study of this course includes consideration of the classification of neutrons by energy, neutron sources, neutron interaction with matter, as well as consideration of photonuclear reactions, types of neutrons, sources of energy released in a nuclear reactor, distribution of gamma radiation energy between different types of radiation, neutron radioactivity, gamma radioactivity, methods for obtaining accelerated neutron beams, neutron spectra, etc. gamma quanta, etc.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 A. Kirsanov Separation of signals from neutrons and gamma quanta by the method of normalized signals //2020 J. Phys.: Conf. Ser. 1690 012057. 2 P. Mortreau, R. Berndt, Handbook of gamma spectrometry For Non-destructive Assay of Nuclear Materials. Joint Research Centre. -2006.-330 p. 3 IARC Monographs on the Evaluation of Carcinogenic Risks to Humans.2000. - No. 75.- Ionizing Radiation, Part 1: X- and Gamma (γ)-Radiation, and Neutrons.

Module 7

Module code and name	NCPh 53114 Statistical model and thermodynamical properties of nuclei
Semester(s) in which this module is taught	1
Person responsible for the module	K.Sh.Zhumadilov
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Basic (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Exotic nuclei. 2. Physics of heavy ions. 3. Registration and spectrometry of heavy ions and products of nuclear reactions.
Module objectives / intended learning outcomes	To provide knowledge about the experimental properties and theoretical models of nuclei formed during nuclear reactions, familiarization with the basic methods for calculating the thermodynamic characteristics of nuclei and their decay channels. / Know the experimental properties and theoretical models of nuclei, be able to apply and evaluate the basic models of nuclear reactions in practice conducted in research institutes, be able to calculate the angular and energy distributions of particles emitted by a composite nucleus.
Course content	The study of this course involves deepening the basic concepts, modern ideas about the composite nucleus that occurs during nuclear reactions, and methods for calculating various characteristics of the decay of the compound nucleus. During the course, the undergraduate studies the properties of low-energy nuclear reactions in the collision of atomic nuclei with neutrons and nuclei
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Paul Fanto E. Statistical Properties of Nuclei: Beyond the Mean-Field Approximation. - Yale University. - 2021.- 239 p. 2 Chen Dayou Statistical model of nuclide shell structure //Physics & Astronomy International Journal. – 2018. - Volume 2, Issue 1.-P. 1-9. 3 Agrawal B. K. Thermal properties of the nuclear surface //Physical Rewiev C.- 2014.- P.1-11.

Module 8

Module code and name	NCPh 53115 Detecting equipment of nuclear physical experiment
Semester(s) in which this module is taught	1
Person responsible for the module	D.I.Shlimas
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Basic (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 15 hours , practical : 30 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Programming. 2. Physics of accelerators. 3. Nuclear radiation detectors.
Module objectives / intended learning outcomes	To acquire knowledge for mastering fundamental concepts, laws used when working with equipment intended for nuclear physics experiment, to develop skills of working with equipment, as well as with various methods of detecting nuclear radiation. / Be able to use the acquired knowledge about the principles of conducting a nuclear physics experiment, about the principles of operation of various installations for the qualitative conduct of further theoretical and experimental research in research activities, master the skills of working on various equipment for conducting nuclear physics experiments, in particular for detecting and registering quantum particles to determine the angular and energy distribution nuclear reaction products.
Course content	The study of this course is associated with high achievements in the field of solid state physics, in the field of gas discharge physics, accelerator technology, as well as methods of high-speed computing, the course also implies the assimilation of a rich arsenal of tools used to register nuclear radiation, in particular issues such as providing high voltage detectors of nuclear radiation, measurement and implementation of amplification the signal of registration of nuclear radiation. The characteristics of detectors, types of radiation, methods of their registration and spectrometry are studied.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 L. Sartini Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment// Spectrometers. -2010. P.1-10. 2 Wang Qiu-kuan, Lin Chang-hua,Yang Yan Advanced Measuring (Instrumentation) Methods for Nuclear Installations//A Review Science and Technology of Nuclear Installations.-2012.-P.2-10. 3 R. I. Scherpelz and J. E. Tanner Neutron measurements at nuclear power reactors//Nuclear Instruments and Methods in Physics Research. 2002. -vol. 476, №. 1-2, P. 400–404.

Module 9

Module code and name	NCPh 53116 Electronics of nuclear physical experiment
Semester(s) in which this module is taught	1
Person responsible for the module	A.L.Kozlovsky
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Basic (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 15 hours, practical : 30 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Experimental methods of nuclear physics. 2. Electronics. 3. Programming.
Module objectives / intended learning outcomes	To provide students with knowledge about modern software products, about the electronic part of nuclear physics experiment, which are used in leading scientific centers for the study of nuclear processes, to provide knowledge that allows expanding or updating the range of knowledge and skills in the field of electronics of nuclear physics experiment. / To master the skills, knowledge of the basic principles of nuclear electronics for solving various theoretical and practical problems, in particular for determining and evaluating the density of levels, excitation energy and other core characteristics of statistical methods for analyzing probability distributions, a systematic presentation of ways to test various hypotheses, the maximum likelihood principle and the Monte Carlo method based on nuclear physical material.
Course content	This course studies the operation of nuclear electronics, for example, when measuring the parameters of the fluxes of nuclear reaction products, the implementation of amplitude-digital transformations, analysis and other processing of the nuclear radiation registration signal, input and output of experimental data, support for the operation of detecting equipment.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 L. Viererbl, Z. Lahodová, A. Voljanskij Measurement of gamma and neutron radiations inside spent fuel assemblies with passive detectors//Nuclear Instruments and Methods in Physics Research A. 2011.-vol. 652, no. 1, P. 90–93. 2 S. Subbuthai, P. Sahoo, R. Ananthanarayanan, A. Nageswara Rao, and R. V. Subba Rao Feasibility studies for the detection of third phase during reprocessing of fast reactor fuel//Journal of Radioanalytical and Nuclear Chemistry.-2012, vol. 291, no. 2, P. 879–883. 3. A. M. Lafleur, W. S. Charlton, H. O. Menlove, and M. T. Swinhoe, Comparison of fresh fuel experimental measurements to MCNPX calculations using self-interrogation neutron resonance densitometry//Nuclear Instruments and Methods in Physics Research A.-2012.- vol. 680, P. 168–178.

Module 10

Module code and name	ENGL 52102 Foreign language (professional)
Semester(s), when the module is taught	2
Responsible for module person	Sagimbayeva D.E.
Language of study	English, Russian, Kazakh
Relationship with curriculum (cycle, component)	Basic (university 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: 120 hours. Practical: 37 hours, independent work of students: 83 hours.
Credit points (total by discipline)	4 ECTS
Required and recommended prerequisites for joining the module	Foreign language B2
Module objectives/intended learning outcomes	The purpose of the discipline: The acquisition and improvement of competencies in accordance with international standards of foreign language education, allowing the use of a foreign language (the level of superbasic standardization (C1) as a means of communication for the successful professional and scientific activities of a future master who is able to compete in the labor market. Intended learning outcomes: - know the functional and stylistic characteristics of the scientific presentation of the material in the studied foreign language; - be able to use general scientific terminology and the terminological sublanguage of the relevant specialty in a foreign language; - freely read, translate original literature in the chosen specialty with subsequent analysis and evaluation of the extracted information; - make a presentation of scientific research (at seminars, conferences, symposiums, forums); - perceive by ear and understand public speeches in direct and indirect communication (lectures, reports, TV and Internet programs); - have the skills to prepare written forms of presentation of information material in the specialty (scientific report, message, theses, abstract, abstract); - have the skills to work with lexicographic sources in a foreign language (traditional and online).
Content	Introduction to the course.Developing a focus. How to write master's dissertation (introductory course).Sourcing information for your project. Developing your project. Using evidence to support your ideas.Avoiding plagiarism. Paraphrasing and summarizing. Academic Style – some guidelines (Part I). Academic styles (Part II). Writing introductions. Incorporating data and illustrations.Writing conclusions. Presentation skills. Preparing for conference presentation. Preparing for a conference presentation.
Examination forms	Oral exam
Study and examination requirements	Master's degree students are required to attend practical classes in a foreign language and take an active part in the implementation of tasks for the individual works of Master's degree students, 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	Databases: https://library.enu.kz/MegaPro/Web https://englishforacademicstudy.com https://garneteducation.com http://presentationexpressions.com http://wiki.ubc.ca/Presentation_Skills https://global.oup.com/?cc=kz, https://www.macmillanyounglearners.com/macmillanenglish/ https://www.britishcouncil.kz/kk https://edpuzzle.com/

Reading list	1. Sagimbayeva J.E., Moldakhmetova G.Z., Kurmanayeva D.K. Tazhitova G.Z., Kassymbekova N.S. English course book for Master programme students of "Governmental audit and Financial control" specialty (from extended reading to academic writing) - Astana: L.N. Gumiloyv Eurasian National University, 2018. – 357p. 2. Sagimbayeva J.E., Kurmanayeva D.K., Tazhitova G.Z., Kassymbekova N.S. Electronic manual - English course book "Environment and Natural Resources Protection" for Master students of "Management and Engineering in the field of Environmental Protection educational programs" – Nur-Sultan, 2022 3. English for Academic Study. Joan McCormack and John Slaght -Extended Writing and Research Skills, University of Reading, 2012 – 152 p. 4. Tamzen Armer - Cambridge English for Scientists – Cambridge University Press, 2013 – 128 p. 4. Martin Hewings – Cambridge Academic English – Upper Intermediate-Cambridge University Press, 2012 – 176 p. 5. Dorothy E. Zemach, Lisa A. Rumisek - Academic Writing: from paragraph to essay. – London: Macmillan Education, 2016 - 130 p. 6. Academic Writing. A Handbook for International students. Stephen Bailey. Routledge. 2011

Module 11

Module code and name	PHIL 52101 History and Philosophy of Science
Semester(s), when the module is taught	2
Responsible for module person	Shamahai S.
Language of study	English, Russian, Kazakh
Relationship with curriculum (cycle, component)	Basic (university component)
Teaching methods	Traditional. Active and interactive teaching methods
Workload (incl. contact hours, self-study hours)	Total workload: 120 hours. Lectures: 15 hours, practical: 23 hours, independent work of students: 82 hours.
Credit points (total by discipline)	4 ECTS
Required and recommended prerequisites for joining the module	World History, Political Science, Sociology
Module objectives/intended learning outcomes	The main goal of the course is to develop undergraduates' interest in fundamental knowledge, stimulate the need for philosophical assessments of the formation and development of sciences, critical analysis of modern scientific achievements, develop a methodological culture of research work Expected learning outcomes: Analyze the main worldview and methodological problems, including those of an interdisciplinary nature, studied in science at the present stage of its development and use the results professionally; understanding the dynamics of the development of science, its impact on the development of society, the formation of a holistic image of science, mastering the theory of method, mastering the logic and methodology of science; mastering in-depth skills in analyzing texts on philosophical problems of various sciences; critical reflection on various concepts of the growth of scientific knowledge; mastering the methodological culture of research work and the ability to use the acquired skills in their own professional activities.
Content	Relationship between the philosophy of science and the history of science. Philosophical ideas as heuristics of scientific research. The problem of demarcation in the philosophy of science. The genesis of science. Discussions about the origin of science. The problem of scientific rationality. classical science. Scientific picture of the world. Ethos of classical science. Non-classical science and post-non-classical science. Scientific picture of the world. The ethos of science. Philosophy of science: basic meanings. Problems of the boundaries of scientific knowledge in the philosophy of I. Kant. Positivist tradition Analytical philosophy and its influence on the philosophy of science. The transition from the logic of science to the history of science. The structure of scientific knowledge. Basic types of sciences. Types of cognitive procedures. Philosophy of natural sciences. Circle of problems of philosophy of natural sciences. Philosophy of technology and technical sciences. The role of technology in science. Information and computer technologies in non-classical technical sciences. Ecological aspects of the social assessment of technology. Specificity of socio-humanitarian knowledge. The problem of the formation of social theory. The theme of "death of the subject" in postmodern philosophy. Time, space, chronotope. The problem of values. post-colonial studies.
Examination forms	Oral exam
Study and examination requirements	To successfully pass the final control, the undergraduate needs to know the terminology, theories and concepts of the discipline. Know personalities and their works. 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	Computer, projector. https://mooc.enu.kz/, https://moodle.enu.kz/
Reading list	1. Kanke V.A. Osnovnye filosofskie napravleniya i koncepcii nauki. M.,2013 2. Kohanovskij V.A. Istoriya i filosofiya nauki.-M., - 2010 3. Klyagin N. Sovremennaya nauchnaya karta mira [Elektronnyj resurs]: uchebnoe posobie / N. Klyagin.- 1, 02 MB.- Moskva: Logos, 2017.- 186 s 4. Kun T. Struktura nauchnyh revolyucij. -M. AST.- 2015 5. Filosofiya nauki: Obshchie problemy poznaniya. Metodologiya estestvennyh i gumanitarnyh nauk: hrestomatiya - M.: Progress-Tradiciya : MPSI : Flinta, 2005. - 992 s. 6. Nurmanbetova, D.N. Istoriya i filosofiya nauki. Astana: ENU, 2012

Module 12

Module code and name	NCPh 52106 Nuclear Models
Semester(s) in which this module is taught	2
Person responsible for the module	A.A.Baratova
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (university component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Introduction to the physics of the atomic nucleus. 2. Statistical model and thermodynamic properties of nuclei. 3. Neutron physics.
Module objectives / intended learning outcomes	To form knowledge about the intracellular structure of the atomic nucleus, the ability to investigate the physical laws of processes occurring in various models of nuclei. / Be able to apply well-known models of the structure and properties of the atomic nucleus, conduct their physical and mathematical modeling from the specified parameters, acquire practical skills in the development of calculations in various models of nuclei.
Course content	Within the framework of this course, different models of nuclei, types of nuclear wave functions, interaction potential, possible states of a system of two nucleons are studied, the energy levels of the nucleus are modeled in various approaches.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 David J. Rowe, John L. Wood. Fundamentals of Nuclear Models: Foundational Models. WorldScientific, 2010. 652 p. 2 Norman D. Cook Models of the Atomic Nucleus. - 2006.-Springer-Verlag Berlin Heidelberg. -291 p. 3 R. F. Casten Nuclear structure form and simple perspective. – 2012.-Oxford University Press. -2015.-391 p.

Module 13

Module code and name	NCPh 53117 Cosmic Ray Physics
Semester(s) in which this module is taught	2
Person responsible for the module	Sh.G.Giniyatova
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Neutrons and gamma quanta 2. Nuclear fission 3. Registration and spectrometry of heavy ions and products of nuclear reactions
Module objectives / intended learning outcomes	To provide knowledge of the main processes in the field of cosmic radiation physics, problems of modern astrophysics, experimental techniques, existing or being created detectors of cosmic particles, electromagnetic radiation from the radio range to gamma rays of Tev energies, as well as neutrino and gravitational radiation. / Master the knowledge of the theory of interaction of high-energy quantum particles and be able to apply this knowledge to research cosmic rays in astrophysical institutes.
Course content	This course contains information about the origin, properties and registration of cosmic radiation, about modern models of the development of the Universe, sources of various cosmic radiation, experimental methods of research of various space systems, issues of experimental study of neutrino and gravitational radiation, as well as the possibility of using cosmic rays to conduct nuclear reactions at ultrahigh energies, the role in the radiation background of the planet, influence on the operation of the equipment of artificial Earth satellites.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Peter K.F. Grieder.- Cosmic Rays at Earth. - Researcher’s Reference Manual and Data Book. -Elsevier. -1117 p. 2 Thomas K. Gaisser. - Cosmic Rays and Particle Physics. - Cambridge University Press. 2016.- 880 p. 3 Schlickeiser R.-Cosmic Rays Astrophysics. - Astronomy and Astrophysics.- 2002.-357 p.

Module 14

Module code and name	NCPh 53118 Nucleosynthesis
Semester(s) in which this module is taught	2
Person responsible for the module	G.D.Kabdrakhimova
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Quantum mechanics. 2. Neutrons and gamma quanta. 2. Nuclear fission.
Module objectives / intended learning outcomes	To form knowledge about the main processes and possible scenarios of the formation of atomic nuclei observed in the visible part of the Universe, models of stars and the main directions of laboratory research on the synthesis of new elements and isotopes, to form modern ideas about nucleosynthesis during the birth and evolution of the Universe. / Get an idea of modern models of the evolution of the Universe, have skills when working with laboratory studies of the main processes of nucleosynthesis, be able to extract nuclear constants necessary to understand scenarios of stellar evolution, and also be able to apply nuclear fusion reactions to generate energy.
Course content	This course examines the main processes and possible scenarios of the formation of atomic nuclei, chemical elements, models of stars and the main directions of laboratory research on the synthesis of new elements and isotopes, the basics of thermonuclear processes in the Universe and their application in energy and experiments, special attention is paid to nuclear reactions in stars: the gorenje hydrogen and helium, nucleosynthesis of supernovae, pre-stellar evolution of the universe.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 N. Langer Nucleosynthesis Bonn University. – 2012. 118 p. 2 F.-K. Thielemann, T. Rauscher, C. Freiburghaus, K. Nomoto, M. Hashimoto, B. Pfeiffer Nucleosynthesis basics and applications to supernovae.-2010. Cambridge University Press. -P. 27-78. 3 C. Patrignani Big ban Nucleosynthesis. – 2016.- Chin. Phys. C, 40.- P.1-15.

Module 15

Module code and name	NCPh 53119 Physical principles of radiation diagnostics and therapy
Semester(s) in which this module is taught	2
Person responsible for the module	A.M. Kabyshev
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. The use of nuclear installations in medicine. 2. Nuclear reactions at low energies. 3. Detecting equipment of the nuclear physics experiment.
Module objectives / intended learning outcomes	To familiarize with the basics and principles of methods of radiation diagnostics, to give an idea of the materials of primary studies (radiographs, linear and computed tomograms, echograms, MRI images, scintigrams). / To acquire the skills of determining the methods of radiation research and further therapy, to be able to apply the knowledge gained about the methods of nuclear medicine in the activities of diagnostic and therapeutic centers of healthcare institutions.
Course content	During the study of this course, the latest scientific data on the physical principles of various methods of radiation diagnostics, X-ray diagnostics, ultrasound diagnostics, X-ray computed tomography, magnetic resonance imaging are highlighted, the physical and technical foundations of methods of radiation diagnostics and therapy, the possibilities of individual medical imaging technologies in the study of various organs and systems are outlined.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 F. M. Khan. The Physics of radiation Therapy. -2003. – Lippincott Williams & Wilkins. 170 p. 2 R Paul Symonds, Charles Deehan, Catherine Meredith. - Walter and Miller's Textbook of Radiotherapy.- -2012. Springer Berlin, Heidelberg. p.667 3 Seymour H. Levitt, James A. Purdy, Carlos A. Perez, Philip Poortmans.- Technical Basis of Radiation Therapy. Practical Clinical Applications. -2012. Springer Berlin, Heidelberg. p.1148.

Module 16

Module code and name	NCPh 53120 Radiochemistry
Semester(s) in which this module is taught	2
Person responsible for the module	G. Ergaliuly
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Physics of accelerators. 2. Registration and spectrometry of heavy ions and products of nuclear reactions. 3. Atomic and nuclear physics.
Module objectives / intended learning outcomes	To provide knowledge about the fundamentals of radiochemistry and their application in the nuclear industry, nuclear physics, in scientific research, for the technology of processing natural uranium and irradiated nuclear fuel, for monitoring the operation of nuclear reactors. / To be able to apply knowledge, skills and abilities for the independent meaningful application of radiochemical and radiometric techniques, to be able to apply the acquired knowledge about the chemical properties of radioactive elements in the activities of research and industrial institutions of the energy industry, to be able to carry out work in physico-chemical laboratories with compounds of radioactive elements, research, analysis of experimental results.
Course content	The content of the course implies the study of methods of radiation chemistry, the main directions of radionuclide, radioimmune chemistry in scientific activities at nuclear industry enterprises and research institutes, and also contains information about the chemistry of the ultra-diluted state, radioactive equilibria in natural and reactor radioactive families, modern methods of separation, concentration, processing of radioactive substances are shown.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Jason S. Lewis, Albert D. Windhorst, Brian M. Zeglis Radiopharmaceutical Chemistry. -2019.- Springer Nature Switzerland AG 651 p. 2 Gregory Choppin, Jan-Olov Liljenzin. - 2013. – Elsevier. - Radiochemistry and Nuclear Chemistry. 850 p. 3 Jozsef Konya, Noémi M Nagy Nuclear and Radiochemistry- 2012. – Elsevier. - Radiochemistry and Nuclear Chemistry. 710 p.

Module 17

Module code and name	NCPh 62107 Nucleon and cluster structure of atomic nucleus
Semester(s) in which this module is taught	3
Person responsible for the module	O.S.Bayakhmetov
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (university component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Statistical model and thermodynamic properties of nuclei. 2. Introduction to the theory of the atomic nucleus. 3. Nuclear Models.
Module objectives / intended learning outcomes	To form ideas about theoretical models for describing the cluster structure and cluster properties of nucleon and quark nuclear systems, to give knowledge about studies based on them of cluster phenomena in complex fermionic systems. / Acquire knowledge and master skills in the development of effective microscopic and semifenomenological methods for studying multiparticle nuclear physical systems with strong interaction and complex structure, in which structuring into composite subsystems takes place.
Course content	In this course, the proposed model of the nucleon structure of the nuclei of chemical elements is considered. The nucleonic structure of the atomic nucleus is studied, the change in the properties of elements depending on the structure of energy levels, the issues of the most important subatomic structures, nucleon clusters, Boromey nuclei, the role of isotopic spin theory in the nucleon model of the nucleus, the elementary theory of the deuteron as the simplest system of two nucleons, the role of alpha clusters in the structure of light nuclei are highlighted.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Christian Beck Clusters in Nuclei. - 2010.- Springer Berlin, Heidelberg. -316 p. 2 Bo Zhou, Yasuro Funaki, Hisashi Horiuchi Nonlocalized clustering and evolution of cluster structure in nuclei // Frontiers of Physics. -2019.- Springer. - 14401. 3 M. Freer, H. Horiuchi, Y. Kanada-En’yo, D. Lee, and U.-G. Meißner, Microscopic clustering in light nuclei. -2018.- Rev. Mod. Phys.- 90, 035004.

Module 18

Module code and name	EDUC 62008 Practice oriented module (Teaching internship)
Semester(s) in which this module is taught	3
Person responsible for the module	G.E.Sataeva
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Basic (university component)
Teaching methods	Practice oriented
Workload (incl. contact hours, self study hours)	Total workload: 120 hours
Amount of credits (total over the module)	4 ECTS
Required and recommended prerequisites for attaching to the module	Higher school pedagogy
Module objectives / intended learning outcomes	To familiarize with the specific conditions of professional pedagogical activity. / Consolidate the theoretical knowledge gained in general professional and special disciplines
Course content	study of teaching methods and pedagogical experience of teachers of faculty departments; conducting various types of classes using the developed pedagogical methods and techniques; development of communication skills; development of interest in research work in the field of teaching methods of an educational subject.
Exam Forms	Report
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale.
Technical, multimedia tools and software	Multimedia
Bibliography	1 Теория и практика инклюзивного образования : учебное пособие / С.С. Жубакова. - Алматы : ССК, 2017. - 147, [1] с. - Библиогр.: с. 140-146 и в конце разд. - ISBN 978-601-310-641-0. 2 Педагогикалық практика туралы ереже = Положение о педагогической практике / жалпы редакциясын басқарған С.Ә. Әбдіманапов ; құрастырушылар: Г.Ж. Меңлібекова, Р.Х. Аймағамбетова, Н.Э. Романенко, Г.Ф. Гижа. - Астана : Л.Н. Гумилев атындағы ЕҰУ, 2005. - 36 б. 3 Методические рекомендации по организации вузовской педагогической практики магистрантов научно-педагогического направления подготовки / Л.В. Нефедова, Т.Г. Котлярова; Министерство образования и науки Республики Казахстан ; Евразийский национальный университет им. Л.Н. Гумилева. - Астана : ЕНУ им. Л.Н. Гумилева, 2005. - 48 с. - Авт. указаны на обороте тит. л. - ISBN 9965-662-99-1. 4 Развитие форм организации обучения в педагогической теории и практике: учебное пособие / Н.А. Смирнова; Министерство Образования Российской Федерации. - Псков : ПГПИ, 2004. - 124 с. - ISBN 5-87854-292-7. 5 Учебная программа и методические рекомендации по организации и проведению педагогической практики студентов и магистрантов университета : учебно-методическое пособие / С.А. Абдыманапов, Л.В. Нефедова; Министерство образования и науки Республики Казахстан, Евразийский национальный университет им. Л.Н. Гумилева. - Алматы : Рауан, 2001. - 148, [1] с. - Библиогр.: с. 143-148. - ISBN 9965-438-78-1.

Module 19

Module code and name	NCPh 63121 Methods of nuclear physical experiment
Semester(s) in which this module is taught	3
Person responsible for the module	A.S. Nygymanova
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Experimental methods of nuclear physics 2. Detecting equipment of nuclear physics experiment. 3. Electronics of the nuclear physics experiment.
Module objectives / intended learning outcomes	To form the ability to develop methods of nuclear physics experiment, to carry out measurements, to form ideas on the basics of nuclear electronics; the probability of nuclear processes; methods of particle identification; features of conducting experiments on radioactive beams. / To use the acquired knowledge about experimental methods of studying physical phenomena, processes, physical properties of substances and materials used in various fields of nuclear physics, to acquire skills and abilities that allow to find out the physical principles of the basic nuclear physical methods and the possibilities of their application.
Course content	The course is devoted to familiarization with various experimental methods in nuclear physics, presentation of the main methods and methods of processing experimental results and presentation of experimental data of nuclear physics experiment. Familiarity with various methods of obtaining physical information from the observed spectra. Particular attention is paid to assessing the reliability of the results obtained, the influence of instrumental resolution and statistical significance.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 A. Dolinskii Antiproton complex at the FAIR project //Nuclear Instruments and Methods in Physics. -2011. -P. 16-24. 2 R.J. Pasquinelli, et.al., Progress in antiproton production at the FERMIILAB TEVATRON collider, in: Proceeding of the Particle Accelerator Conference, Vancouver. - 2009.- TU6PFP075. 3 H. Stockhorst, Stochastic momentum cooling experiments with a barrier bucket cavity and internal targets at COSY-Juelich in preparation for HESR at FAIR, in: Proceedings of the 1st International Particle Accelerator Conference, Kyoto. - 2010.- MOPD068.

Module 20

Module code and name	NCPh 63122 Devices and technique of nuclear experiment
Semester(s) in which this module is taught	3
Person responsible for the module	B.A.Urazbekov
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Experimental methods of nuclear physics 2. Programming. 3. Nuclear radiation detectors.
Module objectives / intended learning outcomes	To provide basic knowledge in the field of development of equipment and methods of physical measurements of nuclear physics, analysis of physical measurements, automation of the experiment. / To form skills to apply the acquired knowledge about the principles of operation of devices and techniques of nuclear physics experiment to study the properties of atomic nuclei, as well as phenomena and processes involving them, to master the skills of working with spectrometric and special measuring instruments, radiation detectors, analog-digital signal converters, sources of spectral and ionizing radiation, with the methodology of spectroscopic measurements, master the skills of working with instruments and various techniques of nuclear experiment to create programs and automate experiments using modern information technologies.
Course content	The course content highlights various principles of operation of measuring instruments of nuclear technology for experimental nuclear research, studies the operation of modern equipment used in analytical and physico-chemical research, examines instruments for measuring various electrical, optical and ionizing effects, contains information about measurement techniques in the field of nuclear physics, in the field of interaction of laser radiation with matter.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Tavernier S. Techniques for Nuclear and Particle Physics Experiments. – 2010. Springer. – 312 p. 2 D.G. Cacuci Handbook of Nuclear Engineering. – 2010. Springer. - 3600 p. 3 G.F. Knoll. - Radiation detection and measurement, 3rd edition. -2000.- John Wiley & Sons. 536 p.

Module 21

Module code and name	NCPh 63123 Statement of nuclear physics experiments in the study of exotic nuclei and correlation
Semester(s) in which this module is taught	3
Person responsible for the module	A.B. Useinov
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	Experimental methods of nuclear physics
Module objectives / intended learning outcomes	Be able to apply the acquired knowledge to conduct experiments on the study of extreme states of exotic nuclei in research institutes. / Be able to calculate and measure correlations in the interactions of accelerated beams of exotic nuclei with target nuclei when conducting experiments
Course content	In the course of mastering the course, the physical principles of experimental methods for studying exotic states of atomic nuclei are studied. The following features of exotic nuclei are considered: high angular momentum, high excitation energy, short lifetime, strongly deformed nuclei, nuclei with an abnormally high/low number of neutrons or protons, superheavy nuclei, halo nuclei, nuclei of new elements that are absent in the nature of the Earth
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Jonson B. Exotic nuclei // Вестник Российской академии наук. - 2019. - Vol. 89. - N. 6. - P. 571–581. 2 Grigorenko L. V., Golovkov M. S., Krupko S. A. Studies of light exotic nuclei in vicinity of neutron and proton drip - lines at FLNR JINR //*Phys. Usp. Vol.*59 P.321–366. 3 Geissel H. in Exotic Nuclei, EXON-2014, Proc. of Intern. Symp. on Exotic Nuclei, Kaliningrad, Russia. - 2014.- P.8-14.

Module 22

Module code and name	NCPh 63124 Accumulation and processing of experimental data in nuclear physics
Semester(s) in which this module is taught	3
Person responsible for the module	F.U. Abuova
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. The interaction of radiation with matter. 2. Experimental methods of nuclear physics. 3. Electronics of nuclear physics experiment.
Module objectives / intended learning outcomes	To form knowledge in the field of statistical methods of experimental data processing in nuclear physics, to update the range of knowledge and skills in the field of statistical methodology for collecting and processing nuclear physical information. / Be able to evaluate the accumulated results of nuclear physics experiments, process statistical data, master the skills of processing experimental data using numerical methods.
Course content	In this course, practical research methods used in measurement statistics in nuclear physics are studied, the main components of methods for obtaining and processing experimental data using modern digital recording computer and software tools are studied, the issues of accumulation and processing of data obtained during the experiment are considered.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Equipment Qualification for Nuclear Installations. – 2021.-IAEA Safety Standards Series No. SSG-69 Specific Safety Guides. -53 p. 2 Hibbs M. the future of the Nuclear Suppliers Group. -2011. – 70 p. 3 Lamarsh John R. Introduction to Nuclear Engineering Third Edition -2001.- p. 801.

Module 23

Module code and name	NCPh 63125 Physics and theory of nuclear reactors
Semester(s) in which this module is taught	3
Person responsible for the module	D.A.Sailaubek
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Fission of atomic nuclei 2. Nuclear reactions at low energies. 3. Neutron physics.
Module objectives / intended learning outcomes	To familiarize with neutron-physical processes occurring in the core of nuclear reactors, methods of their calculation, the relationship of neutron-physical and thermohydraulic processes, their influence on the choice of materials and reactor design. / Be able to apply theoretical knowledge in the work of industrial and research nuclear reactors in nuclear power plants, as well as scientific organizations, including those based on educational and research reactors, master the skills of using the theoretical knowledge obtained to analyze the physical characteristics of nuclear reactors and predict changes in their characteristics based on the use of neutron-physical and structural characteristics.
Course content	While mastering the course, the features of the neutron cycle in a nuclear reactor, the laws of neutron diffusion in media and the distribution of neutron fields, the basics of nuclear reactor physics and methods of neutron physics calculations are studied: the effective neutron multiplication coefficient, the laws of the formation of the spatial energy distribution of neutrons and the distribution of internal energy, the neutron diffusion equation, the neutron transfer equation, the multigroup model of the reactor, numerical methods of reactor calculation, types of reactors, functional elements of the reactor, calculation of pressure on the reactor wall, reactor "pits", neutron free path length and reaction cross section in the reactor, reactor safety. the main regularities of the cross-section of the interaction of neutrons with materials of reactor media.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Dam H. Nuclear Reactor Physics. –Delft University of Technology Physics of Nuclear Reactors 2005.-132 p. 2 Weston M. Stacey Nuclear Reactor Physics.-Willey.-VCH.-2007. -p. 738. 3 Lewis E. Fundamentals of Nuclear Reactor Physics. – 2009.-AP.-p.269.

Module 24

Module code and name	NCPh 63126 Mechanism of interaction of light ions of low energies with atomic nuclei
Semester(s) in which this module is taught	3
Person responsible for the module	B. Mauey
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (Elective component)
Teaching methods	Lecture, Practical exercises, Self-study
Workload (incl. contact hours, self study hours)	Total workload: 150 hours . Lectures: 30 hours , practical : 15 hours. , independent work of students : 105 hours.
Amount of credits (total over the module)	5 ECTS
Required and recommended prerequisites for attaching to the module	1. Models of nuclei. 2. Experimental methods of nuclear physics. 3. Nuclear reactions at low energies.
Module objectives / intended learning outcomes	To give fundamental ideas about the nature of the interaction of light ions with atomic nuclei at low energies, to form ideas about the physical and chemical processes taking place inside the nucleus, about the formation of structural-phase and dimensional stability under the influence of light ions. / Be able to apply the acquired knowledge in the field of interaction of accelerated beams of light charged particles with nuclear targets at low energies in practice conducted in research institutes
Course content	This course contains information about the mechanisms of interaction between atomic nuclei and light ions, about the energy losses during the passage of low-energy ions through matter and the occurrence of radiation defects, discusses the scattering of low-energy ions, the role of inelastic processes in ion scattering, damage to the surface of solids under the action of ion bombardment and the anisotropy of the spatial distribution of scattered particles.
Exam Forms	Two intermediate controls and one final exam, written assignments for homework. Forms: oral, written, test. Duration is optional.
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale. The final assessment of the module consists of 40 % success in exams, 30 % of tests, 10 % homework and 20 % participation in class. Students must have a final grade of 50% or higher to pass
Technical, multimedia tools and software	Multimedia
Bibliography	1 Genes C. Quantum Physics of Light-Matter Interactions. -p. 91. 2 Boztosun I., Mackintosh R. S. Investigation of the coupling potential by means of S-matrix inversion. -2002.-Phys. Rev. Vol 66. P.1-9. 3 Farag M.Y.H. Nucleus-Nucleus Elastic Scattering with Pauli Correlation// Effect Czechoslovak Journal of Physics.-2004.-Vol.54.-P. 633–641.

Module 25

Module code and name	EDUC 62009 Practice oriented module (Research practice)
Semester(s) in which this module is taught	4
Person responsible for the module	A.G.Zhumalina
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	Profiling (university component)
Teaching methods	Practice oriented
Workload (incl. contact hours, self study hours)	Total workload: 420 hours
Amount of credits (total over the module)	14 ECTS
Required and recommended prerequisites for attaching to the module	Teaching internship
Module objectives / intended learning outcomes	To acquaint with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data. / Develop the ability to independently perform research related to solving professional tasks necessary for current or future professional activities, as well as gaining experience in managerial, organizational and educational work in a team.
Course content	The content of the research practice is determined by the work program of the practice, taking into account the specifics of the direction of training determined by the supervisor and the department to which the graduate student is attached, as well as the place and conditions of the research practice.
Exam Forms	Report
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale.
Technical, multimedia tools and software	Multimedia
Bibliography	1 Академиялық сауаттылықтың теориялық және практикалық негіздері : оқу құралы / Б.Б. Динаева, С.М. Сапина. - Толық. 2-бас. - Нұр-Сұлтан : [б. и.], 2020. - 199, [1] б. - Библиогр.: б. 195. - ISBN 978-601-7538-27-9. - Текст : электронный. 2 Основы научно-педагогических исследований : учебное пособие : курс лекций для бакалавриата / Мынбаева Айгеним Казыевна; Казахский национальный университет им. аль-Фараби. - Алматы : Қазақ университеті, 2013. - 220 с. - Библиогр.: с. 218-219. - ISBN 978-601-04-0318-5. 3 Диссертация и ученая степень : пособие для соискателей / Б.А. Райзберг. - 3-е изд., доп. - Москва : ИНФРА-М, 2003. - 409, [2] с.

Module 26

Module code and name	MFA 62110 Module of final assessment
Semester(s) in which this module is taught	4
Person responsible for the module	K.A.Kuterbekov
Language of teaching	English, Russian, Kazakh
Connection with the curriculum (cycle, component)	final assessment
Teaching methods	Practice oriented
Workload (incl. contact hours, self study hours)	Total workload: 360 hours
Amount of credits (total over the module)	12 ECTS
Required and recommended prerequisites for attaching to the module	All other modules of the educational program
Module objectives / intended learning outcomes	Prepare a master's thesis for defense. / To defend a master's thesis
Course content	Accomplishment and defense of Master’s degree thesis
Exam Forms	Defense of degree work
Tuition and Exam Requirements	Educational achievements (knowledge, skills, abilities and competencies) of students are evaluated on a 100-point scale corresponding to the international letter rating system (positive grades as they decrease from “A” to “ D ”, “unsatisfactory” - “ F X”, “ F ") with the corresponding digital equivalent on a 4-point scale.
Technical, multimedia tools and software	Multimedia
Bibliography	1 Академиялық сауаттылықтың теориялық және практикалық негіздері : оқу құралы / Б.Б. Динаева, С.М. Сапина. - Толық. 2-бас. - Нұр-Сұлтан : [б. и.], 2020. - 199, [1] б. - Библиогр.: б. 195. - ISBN 978-601-7538-27-9. - Текст : электронный. 2 Основы научно-педагогических исследований : учебное пособие : курс лекций для бакалавриата / Мынбаева Айгеним Казыевна; Казахский национальный университет им. аль-Фараби. - Алматы : Қазақ университеті, 2013. - 220 с. - Библиогр.: с. 218-219. - ISBN 978-601-04-0318-5. 3 Диссертация и ученая степень : пособие для соискателей / Б.А. Райзберг. - 3-е изд., доп. - Москва : ИНФРА-М, 2003. - 409, [2] с.

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date 12.12.2022 Record № 5

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