MINISTRY OF EDUCATION AND SCIENCE
REPUBLIC OF KAZAKHSTAN

KAZAKH NATIONAL TECHNICAL UNIVERSITY
named after K.I.SATPAYEV

Module reference book or collection of module descriptions in the specialty 7M07103 "Materials science and technology of new materials"

Almaty 2022

A module reference book or a collection of module descriptions, which is also available to students for review, should contain the following information about individual modules:

Module designation	**Profile training module**
Semester(s) in which the module is taught	**Autumn, spring (1,2)**
The person responsible for the module	**Telesheva Asel Bolatovna**
Language	**Kazakh, Russian**
Attitude to the curriculum	**Mandatory**
Teaching methods	**Lecture, practical work, independent work of a graduate student.**
Workload (including contact hours, self-study hours)	**(Approximately) Total workload:** 270 hours Lectures 45 Practical 90 I 135 **Contact hours (please specify lectures, exercises, laboratory classes, etc.):** **Private training with exam preparation, indicated in hours 1:**
Credits	**18**
Necessary and recommended prerequisites for joining the module	**Intermediate english, Philosophy**

Module objectives / expected learning outcomes	**The purpose of the module is to study, using a philosophical approach, the foundations and boundaries of science and technology, the laws of their development, prospects and strategies for future existence. Formation of professionally oriented communicative competence of undergraduates, which allows them to integrate into the international professional environment and use professional English as a means of intercultural and professional communication. And also the study of the basics of education management, management of global educational processes and the basics of management psychology.** **The master's student will be able to identify and analyze the connections, correlation between natural science, technical and philosophical fields of knowledge, their mutual determination, place and role in culture. He will know the main problems of modern science and technology, the prospects for new discoveries, and outline ways out of the crisis of man-made civilization.** **Know the basics of education management, management of global educational processes.**

Description	*The description of the content should clearly indicate the main directions and the level of complexity.* **Familiarization of undergraduates with the history of the formation and development of science, technology, its conceptual basis; to present the foundations and structure of science, technology; to consider the features of the current stage of development of science and its prospects; to substantiate the principles and laws of categorical thinking in the field of science; to analyze methods and procedures of scientific cognition; to present basic natural science theories within the boundaries of mega-; macro-; microcosm; to determine the philosophical foundations and boundaries of technology; to demonstrate the diversity of meanings of technology and ways of its implementation.** **Study of the basics of education management, management of global educational processes, analysis and selection of strategic initiatives, project as a strategy for managing the development of an educational institution/organization. Also, undergraduates will study education marketing, human resource management in educational organizations, information and communication technologies in the field of education and educational process management (using the example of higher education).** **Teaching the basics of management psychology. Specifics of management psychology, psychological patterns of managerial activity, personality and its potential in the management system; motivation and effectiveness in the organization, leadership and leadership in modern management of organizations, social group as an object of management, psychological foundations of managerial decision-making, business communication and managerial conflicts, psychology of responsibility, image creation as an integral part of the culture of communication, psychology of advertising.**

Exams and assessment formats	**Two written/oral intermediate tests (30 minutes each) and one final oral exam (40 minutes), short computer quizzes, written homework** **The module exams are conducted in the format of test tasks. The test consists of several sections, each of which is allocated a certain amount of time and points at the discretion of the teacher, but the total time allocated to the student to provide an answer to the exam ticket should not exceed 120 minutes, and the maximum number of points is 40. And also the teacher adheres to the following evaluation criteria:**

Requirements for studies and exams	**Requirements for successful completion of the module, for example, the final assessment of the module consists of 60% of academic performance in exams, 10% of quizzes, 10% of homework, 10% of class participation. To pass the exam, students must have a final grade of 60% or higher.** **Admission of students to the exam in the discipline is carried out automatically:** **- based on the assessment of the admission rating, determined by the results of the current and boundary control of academic performance (the total number of required semester points is at least 25 for two attestations);** **- those who have no outstanding tuition fees;** **- those who do not have more than 20% of skipping classes in the discipline;** **- not being on academic leave or academic break;** **those who do not have an overdue medical examination.** **The final assessment of the discipline includes assessments of current academic performance and final control. The assessment of current academic performance (admission rating) is 60% of the final assessment of knowledge in the discipline, the assessment of the exam is 40% of the final assessment of knowledge in this discipline. Thus, the final grade for each discipline is determined as the sum of the points scored by the student according to the results of the current and boundary performance controls (rating - maximum 60 points, minimum 25 points) and the exam (final control - maximum 40 points, minimum 20 points), which together makes up a maximum of 100 points.**

Reading list	**1) Valiano M.V. History and Philosophy of Science [Electronic resource]: Textbook. Moscow: Alfa-M; Moscow: LLC "INFRA-M Scientific and Publishing Center", 2015. - 208 p. (EBS "INFRA-M")** **2) Bessonov B.N. History and Philosophy of science: textbook. manual / B. N. Bessonov. - Moscow: Yu Wright: I D Yurite, 2010. - 394, [6] p.** **3) History and Philosophy of Science = History and Philosophy of Science: studies. manual / under the general editorship of S. A. Lebedev. - - Moscow: Acad. Project: Alma Mater, 2007. - 606, [2] p.** **4) Ostrovsky E.V. History and philosophy of science: studies. handbook for university students / E. V. Ostrovsky. - - Moscow: UNITY-DANA, 2007. - 159, [1] p** **. 5) V. L. Kaushanskaya, R. L. Kovner, O. N. Kozhevnikova, E. V. Prokofiev, 3. M. Raines, S. E. Skvirskaya, F. Ya. Tsyrlina grammar of the English language6) English for academic study: Reading and Writing. Source Book. - Slaght J., Harben P., Pallant A. University of Reading 2006** **7) Listening Extra. Resource book. - Miles Craven. Cambridge University Press 2004** **8) Bordovskaya N.V., Rean A.A. Pedagogy, St. Petersburg, 2008** **9) Isaev I.F. Professional and pedagogical culture of a teacher: Textbook. for university students. M., 2003.** **10) Shane E. Organizational culture and leadership. St. Petersburg Publishing House, St. Petersburg, 2002.**

Module designation	**Practice-oriented module**
Semester(s) in which the module is taught	**Spring (2,4)**
The person responsible for the module	**Telesheva Asel Bolatovna**
Language	**Kazakh, Russian**
Attitude to the curriculum	**Specialization**
Teaching methods	**Conducting experiments and methods of processing experimental studies.** **Methods of teaching special disciplines.**
Workload (including contact hours, self-study hours)	***(Approximately) Total workload:*** 165 hours ***Contact hours (please specify lectures, exercises, laboratory classes, etc.):*** ***Private training with exam preparation, indicated in hours 1:***
Credits	**11**
Necessary and recommended prerequisites for joining the module	
Цели модуля / предполагаемые результаты обучения	**Consolidation of pedagogical skills in the educational environment (college, institute, university) and conducting research.** **Obtaining skills for conducting classes, using elements of interactive, distance learning.** *The key question is: What learning outcomes should students achieve in the module?* *For example. from the point of view of:* *- Knowledge: familiarity with information, theory and/or subject knowledge* *Skills: cognitive and practical abilities, for the development of which knowledge is used.* *- Competencies: integration of knowledge, skills, social and methodological abilities in work or training situations2.* *For example: "Students know that / can / can..."*

Description	*The description of the content should clearly indicate the main directions and the level of complexity.* **Passing pedagogical practice in the conditions of an educational organization, conducting lectures, practical and laboratory classes. Passing of research practice in the conditions of scientific laboratories and the organization of the scientific and educational sphere.**
Exams and assessment formats	*Two written/oral intermediate tests (30 minutes each) and one final oral exam (40 minutes), short computer quizzes, written homework* **Writing and protecting a report on the work done**
Requirements for studies and exams	*Requirements for successful completion of the module, for example, the final assessment of the module consists of 60% of academic performance in exams, 10% of quizzes, 10% of homework, 10% of class participation. To pass the exam, students must have a final grade of 60% or higher.*
Reading list	**1) Methodical instruction on conducting research practice of undergraduates of specialty 6M07100 - "Materials science and technology of new materials", KazNRTU, 2015**

Module designation	**Professional Engineering Training module**
Semester(s) in which the module is taught	**Autumn, spring (1,2)**
The person responsible for the module	**Telesheva Asel Bolatovna**
Language	**Kazakh, Russian**
Attitude to the curriculum	**Specialization**
Teaching methods	**Lecture, practical work, independent work of a graduate student.**

Workload (including contact hours, self-study hours)	*(Approximately) Total workload:* **270 hours** **Lectures 90** **Practical 45** **SRS 135** *Contact hours (please specify lectures, exercises, laboratory classes, etc.):* *Private training with exam preparation, indicated in hours 1:*
Credits	**18**
Necessary and recommended prerequisites for joining the module	**Physics II, Mathematics II, Materials Science and Advanced Materials**
Module objectives / expected learning outcomes	**The purpose of the module is to familiarize undergraduates with innovations in the field of installation, commissioning, MRO, monitoring and diagnostics of technical condition.** **Will know the essence of innovative solutions, calculation methods with elements of research.** **Be able to put into practice innovative solutions in the above areas using modern technical means and digital technologies.** *The key question is: What learning outcomes should students achieve in the module?* *For example. from the point of view of:* *- Knowledge: familiarity with information, theory and/or subject knowledge* *Skills: cognitive and practical abilities, for the development of which knowledge is used.* *- Competencies: integration of knowledge, skills, social and methodological abilities in work or training situations2.* *For example: "Students know that / can / can..."*

Description	*The description of the content should clearly indicate the main directions and the level of complexity.* Physical theories and concepts to explain structural patterns in materials; complexes of physical and mechanical properties of materials and technological methods of changing them by influencing structural parameters; technological route maps of technological processes; principles of rational choice of materials to ensure their optimal use in structures and products; information sources, databases for solving professional problems; methods of conducting, analysis and evaluation of experimental research results; ways of creating new materials and their processing. analysis of the structure and properties of a certain class of materials using modern research methods and scientific instruments (electro-physical, optical, electron microscopic, X-ray); modeling of the structure and properties of materials based on mathematical processing of research results and the use of software products of materials science in solving real problems and problems of science and production; selection and use of materials in technological processes of machine-building, energy, oil and gas and other industries, including modern 3D technologies; assessment of the quality of materials taking into account operational, environmental and economic requirements.

Exams and assessment formats	*Two written/oral intermediate tests (30 minutes each) and one final oral exam (40 minutes), short computer quizzes, written homework* **The module exams are conducted in writing. The examination ticket consists of 3 questions (situational tasks, calculations), for each of which, at the discretion of the teacher, a certain amount of time and points are allocated, however, the total time allocated to the student to provide an answer to the examination ticket should not exceed 120 minutes, and the maximum number of points is 40. And also the teacher adheres to the following evaluation criteria:** **1. Accuracy – 35%.** **2. Completeness of the solution of the problem – 35%.** **3. Creativity and originality – 30%.**

Requirements for studies and exams	*Requirements for successful completion of the module, for example, the final assessment of the module consists of 60% of academic performance in exams, 10% of quizzes, 10% of homework, 10% of class participation. To pass the exam, students must have a final grade of 60% or higher.* **Admission of students to the exam in the discipline is carried out automatically:** **- based on the assessment of the admission rating, determined by the results of the current and boundary control of academic performance (the total number of required semester points is at least 25 for two attestations);** **- those who have no outstanding tuition fees;** **- those who do not have more than 20% of skipping classes in the discipline;** **- not being on academic leave or academic break;** **those who do not have an overdue medical examination.** **The final assessment of the discipline includes assessments of current academic performance and final control. The assessment of current academic performance (admission rating) is 60% of the final assessment of knowledge in the discipline, the assessment of the exam is 40% of the final assessment of knowledge in this discipline. Thus, the final grade for each discipline is determined as the sum of the points scored by the student according to the results of the current and boundary performance controls (rating - maximum 60 points, minimum 25 points) and the exam (final control - maximum 40 points, minimum 20 points), which together makes up a maximum of 100 points.**

Reading list	1. Materials science / B.N. Arzamasov, V.I. Makarova, G.G. Mukhin, etc. Under the general editorship of B.N. Arzamasov, G.G. Mukhin. – 3rd ed., reworked. and additional – M.: Publishing House of the Bauman Moscow State Technical University, 2001. – 648 p. 2. Adaskin, A.M. Materials Science (metalworking): Textbook / A.M. Adaskin. - M.: Academy, 2018. - - 240c. 3. Adaskin, A.M. Materials science and technology of metallic, nonmetallic and composite materials: Textbook / A.M. Adaskin, A.N. Krasnovsky. - M.: Forum, 2011. - 144 p. 4. Arzamasov, B.N. Materials science / B.N. Arzamasov. - M.: MSTU , 2008. - 648 p. 5. Bondarenko, G.G. Materials Science. / G.G. Bondarenko. - M.: Higher School, 2007. - 360 c 6. D.U.Smagulov Metallography, Almaty. Kazntu. 2007. -376s. 7. Drozd, M.I. Material Science: Textbook / M.I. Drozd. - M.: Rior, 2013. - 604 c

Module designation	**Module of innovative technologies**
Semester(s) in which the module is taught	**Autumn, spring (1,2,3)**
The person responsible for the module	**Telesheva Asel Bolatovna**
Language	**Kazakh, Russian**
Attitude to the curriculum	**Specialization**
Teaching methods	**Lecture, practical work, calculations.**
Workload (including contact hours, self-study hours)	*(Approximately) Total workload:* *630 hours* *Lectures 210* *Practical 105* *IWS 315* *Contact hours (please specify lectures, exercises, laboratory classes, etc.):* *Private training with exam preparation, indicated in hours 1:*
Credits	**42**
Necessary and recommended prerequisites for joining the module	**Physics II, Mathematics II, Technological quality assurance of materials. Materials for 3d technology. Physico-chemical methods of materials research. New functional materials. Multiphase structures and methods for calculating phase diagrams. Engineering of surface materials. Methodology of selection of materials and technology selection**

Module objectives / expected learning outcomes	**The purpose of the module is to familiarize undergraduates with applied aspects, to form undergraduates' ideas about the mechanisms and patterns of creating composite and powder materials, to obtain a set of knowledge about the relationship of technological parameters with the structure and properties of materials for 3D modeling, as well as to study the quality indicators of materials that determine its performance in products of a specific purpose** **The master's student will know: an idea of the current state of the theory of phase transitions, trends in further development; know the laws and concepts of physical chemistry; be able to analyze phase changes occurring in pure metals and multicomponent systems; possess the skills of constructing and calculating phase diagrams of multicomponent metal systems.** **The key question is: What learning outcomes should students achieve in the module?** **For example. from the point of view of:** **- Knowledge: familiarity with information, theory and/or subject knowledge** **Skills: cognitive and practical abilities, for the development of which knowledge is used.** **- Competencies: integration of knowledge, skills, social and methodological abilities in work or training situations2.** **For example: "Undergraduates know that they can..."**

Description	*The description of the content should clearly indicate the main directions and the level of complexity.* *Studying the possibilities of technological quality assurance of materials for the manufacture of technical products, the course of the discipline also includes the analysis of the causes of quality decline at different stages of the design of the technological process; methods of monitoring (diagnostics) of the state of the material, its defects associated with the violation of technological processes; methods of improving the quality of materials in the technological process of manufacturing parts and structures. Processes in the field of theory and practice of using composite, powder materials, modern scientific concepts on mechanics and physics of molding and sintering processes in order to create a material for 3D technologies with a set of specified properties.* *Obtaining and using composite and powder materials, as well as presenting the mechanism and patterns of materials for 3D modeling, their advantages, disadvantages and main areas of application.* *To find ways to scientifically control the phase composition, structure and properties of alloys, further theoretical and experimental studies of various phase transitions in liquid, solid metals and alloys are necessary. Theoretical studies of phase equilibria in multicomponent metal systems, calculation and prediction of state diagrams have now acquired a large scope. Computational methods make it possible to attract achievements of theoretical physics, computer technology and advances in research of thermodynamic and physical properties of alloys to the construction of state diagrams.* *The choice of optimal materials for technical products and their rational use in production is possible only on the basis of knowledge of the structure and properties of materials, methods of assessing their quality. Therefore, this course of the discipline summarizes the totality of theoretical knowledge and practical techniques used in specific technologies.. As a result of studying this discipline, the methodological culture of a bachelor in the field of engineering and technology in the materials science field of training increases. The*

Exams and assessment formats	**Two written/oral intermediate tests (30 minutes each) and one final oral exam (40 minutes), short computer quizzes, written homework** **The module exams are conducted in writing. The examination ticket consists of 3 questions (theory, situational problems, calculations), for each of which, at the discretion of the teacher, a certain amount of time and points are allocated, however, the total time allocated to the student to provide an answer to the examination ticket should not exceed 120 minutes, and the maximum number of points is 40. And also the teacher adheres to the following evaluation criteria:** **1. Accuracy – 35%.** **2. Completeness of the solution of the problem – 35%.** **3. Creativity and originality – 30%.**

Requirements for studies and exams	**Requirements for successful completion of the module** **, for example, the final assessment of the module consists of 60% of academic performance in exams, 10% of quizzes, 10% of homework, 10% of class participation. To pass the exam, students must have a final grade of 60% or higher.** **Admission of students to the exam in the discipline is carried out automatically:** **- based on the assessment of the admission rating, determined by the results of the current and boundary control of academic performance (the total number of required semester points is at least 25 for two attestations);** **- those who have no outstanding tuition fees;** **- those who do not have more than 20% of skipping classes in the discipline;** **- not being on academic leave or academic break;** **those who do not have an overdue medical examination.** **The final assessment of the discipline includes assessments of current academic performance and final control. The assessment of current academic performance (admission rating) is 60% of the final assessment of knowledge in the discipline, the assessment of the exam is 40% of the final assessment of knowledge in this discipline. Thus, the final grade for each discipline is determined as the sum of the points scored by the student according to the results of the current and boundary performance controls (rating - maximum 60 points, minimum 25 points) and the exam (final control - maximum 40 points, minimum 20 points), which together makes up a maximum of 100 points.**

Reading list	1. **1) Barabanshchikov Yu.G. Material science and technology of structural materials / Yu.G. Barabanshchikov. – St. Petersburg : Publishing House of the Polytechnic University. un-ta, 2006. – 150 p.** 2. **2) Nikulin, S.A. Materials science: special steels and alloys: Textbook / S.A. Nikulin, V.Y. Turilina. - M.: MISIS, 2013. - 123 p.** 3. **3) Adaskin, A.M. Materials science and technology of materials: Textbook / A.M. Adaskin, V.M. Zuev.. - M.: Forum, SIC Infra-M, 2013. - 336 p.** 4. **4) Metallurgy and heat treatment. Reference edition in 3 volumes / Edited by A.G. Rahstadt. – M. : Intermetengineering, 2014** 5. **Bochvar, A.A. Fundamentals of heat treatment of alloys. – M.: Metallurgy Media, 2018. - 779 p.** 6. **5) Dmitrenko, V.P. Materials science in mechanical engineering: Textbook / V.P. Dmitrenko, N.B. Manuilova. - M.: Infra-M, 2017. - 560 c** 7. **Zemskov, Yu.P. Material science: A textbook / Yu.P. Zemskov. - St. Petersburg: Lan, 2019. - 188 c** 8. **6) Foster L. (2008) Nanotechnology. Science, innovations and opportunities. Moscow: Technosphere.** 9. **7) Zemskov, Yu.P. Material Science: Textbook / Yu.P. Zemskov. - St. Petersburg: Lan, 2019. - 188 p.** 10. **8) Kramm, M.N. Welding Materials Science. Melting welding: A textbook / M.N. Kramm. - St. Petersburg: Lan, 2016. - 168 p.**

Module designation	**Научно-исследовательский модуль**
Semester(s) in which the module is taught	**Осень, весна (1,2,3,4)**
The person responsible for the module	**Telesheva Asel Bolatovna**
Language	**Kazakh, Russian**
Attitude to the curriculum	**Specialization**
Teaching methods	**Research work of a master's student, including internship and completion of a master's thesis**
Workload (including contact hours, self-study hours)	*(Approximately) Total workload:* *360 hours* *Contact hours (please specify lectures, exercises, laboratory classes, etc.):* *Private training with exam preparation, indicated in hours 1:*
Credits	**24**
Necessary and recommended prerequisites for joining the module	-
Module objectives / expected learning outcomes	**The purpose of the module is to develop working skills in a research environment.** **Willingness to work independently, the ability to manage your time, plan and organize activities.** **The key question is: What learning outcomes should students achieve in the module?** **For example. from the point of view of:** **- Knowledge: familiarity with information, theory and/or subject knowledge** **Skills: cognitive and practical abilities, for the development of which knowledge is used.** **- Competencies: integration of knowledge, skills, social and methodological abilities in work or training situations2.** **For example: "Students know that / can / can..."**

Description	**The description of the content should clearly indicate the main directions and the level of complexity.** **Research work, research, experiments,, writing an article, internships, including foreign ones and writing a master's thesis.**
Exams and assessment formats	**Two written/oral intermediate tests (30 minutes each) and one final oral exam (40 minutes), short computer quizzes, written homework** **Writing a report on scientific internships, publishing articles**
Requirements for studies and exams	*Requirements for successful completion of the module, for example, the final assessment of the module consists of 60% of academic performance in exams, 10% of quizzes, 10% of homework, 10% of class participation. To pass the exam, students must have a final grade of 60% or higher.* -
Reading list	**In the direction of research of the topic of the dissertation**