NJSC "Kazakh National Research Technical University named after K.I. Satpayev"
Institute of Mining and Metallurgy named after O.A. Baykonurov
Materials Science, Nanotechnologies and Engineering Physics Department

CURRICULUM PROGRAM

"ENGINEERING PHYSICS AND MATERIAL SCIENCE"
Bachelor of Science in
Engineering Physics and Materials Science

on the basis of the following specialties of the former Classifier of Specialties:
5B072300 - "Applied Physics"
5B071000 - "Material Science and Technology of New Materials"

1st edition
In accordance with the State Compulsory Educational Standard of higher education 2018

Almaty 2021

The program is compiled and signed by the parties:

From KazNRTU named after K. Satpayev:
1. Head of MN&EP Department _____ Kakimov U.K.
2. Director of IMM named after O.A. Baykonurov _____ Rysbekov K.B.
3. Chairman of Sc.Method.Council of MN&EP Department _____ Telesheva A.B.

Approved at the meeting of the Academic Board of the Kazakh National Research Technical University named after K. Satpayev. Minutes № 3 dated 25.06.2021.

Approved at the meeting of the Educational and Methodological Board of the Kazakh National Research Technical University named after K. Satpayev. Minutes № 3 dated 19.12.2018.

Qualification:
Level 6 of the National Qualifications Framework:
6B053 Physical and Chemical Sciences (5B072300 - "Applied Physics", 5B071000 - "Material Science and Technology of New Materials")

Professional competence:
- Performance of industrial-technological types of professional activity;
- Ability to work with high-tech, laboratory and research equipment;
- Ability to apply mathematical methods and computer modeling;
- Ability to skillfully solve assigned tasks, collect, process and analyze technical information, conduct necessary research and measurements in the field of materials science, nanotechnology, nuclear technology, space technology, semiconductor electronics

1 Brief description of the program

Engineering Physics and Materials Science curriculum represents the first level of qualification of the three-level higher education system, which provides the basis for subsequent master's programs and further doctoral programs.

The program is aimed at training specialists of a wide activity profile. The necessary basic knowledge and skills in the field of engineering and technology will allow future specialists to easily integrate into the work process of almost any sphere of industry. The educational program provides a scientific basis in the field of materials science, nanotechnology, nuclear technology, space technology, semiconductor electronics. Specialists are trained in research, development, creation and operation of new materials, technologies, devices and appliances. The work of the specialists consists in creation, improvement, exploitation and repair of devices and appliances, creation and research of new materials, as well as their development and implementation of technologies by sectors of application.

Graduates with a Bachelor of Science degree in **Engineering Physics and Materials Science** curriculum have the following options:

- to engage in employment as operating personnel in small and large manufacturing enterprises; in the military-industrial complex; in state and non-state institutions in industry, energy, education; in research and design institutes and laboratories; in companies and firms associated with the supply, adjustment and maintenance of machinery and technology.

- upgrade qualifications in a master's degree program of higher education in an acquired or related specialty on a grant or fee basis.

Operating personnel shall imply: engineering physicist in all production fields; scientific employee of engineering profile in design organizations, institutions, institutes, universities; pedagogical employee; technical specialist, technical consultant in various fields; engineering technician, engineering technologist in the field of materials science (material scientist, metal scientist); research engineer; electronic engineer, etc.

The mission of Engineering Physics and Materials Science curriculum is to provide the market with highly qualified personnel in the field of high technology and material science by means of the development of innovative, scientific and educational environment.

As technology has evolved and instrumentation has improved, modern science has come close to studying the fundamentals of nature, namely the natural properties of substances. Materials science is a modern and dynamically developing science of the structure and properties of materials and their changes under the influence of various factors. Technical physics deals with the fundamental laws of nature and knowledge about the properties of substances, phenomena and processes as practical applications in everyday life, making the science constantly self-improving and forging ahead. The

curriculum has a universal interdisciplinary nature; on the one hand, it is the study and formation of materials, and on the other hand, it is their practical application.

The main goals of the Engineering Physics and Materials Science curriculum are:
1) provision of fundamental and practical training for students for successful solution of scientific and engineering problems in different fields of technical physics and materials science, having interdisciplinary nature, especially in nanotechnology, space and atomic industries, electronic engineering;
2) development of students' skills in engineering analysis and design, staging and conducting scientific research, including as a team member;
3) preparation of students for a successful career in scientific, scientific-production organizations and educational institutions engaged in solving engineering and technical problems by developing their professional and ethical responsibility, ability to independently study and improve their qualification during their life.
4) development of skills in the possession and application of scientific methods of materials acquisition and research.

The main objectives of the Engineering Physics and Materials Science curriculum are:
1) knowledge and understanding of the scientific and mathematical principles underlying the various specializations in engineering physics and materials science;
2) ability to apply acquired knowledge to set, formulate and solve applied scientific problems in engineering physics using recognized methods;
3) ability to apply acquired knowledge to analyze technical systems, processes and methods related to various specializations in engineering physics and materials science, including using simulation methods;
4) understanding of engineering systems design methodologies and ability to apply them;
5) ability to find necessary literature, use databases and other sources of information;
6) ability to analyze, plan and conduct necessary research, interpret data and draw conclusions;
7) ability to select and use appropriate equipment, tools, and techniques;
8) work effectively both individually and as a team member;
9) demonstrate project management and business awareness, knowledge and understanding of the impact of risks and changing conditions;
10) recognize the need for and have the ability to self-study and upgrade skills throughout life;
11) understand health, safety, legal issues, and engineering responsibilities, and understand the impact of engineering decisions on the social context and the environment:
12) follow a code of professional ethics and standards of engineering practice

2 Requirements for applicants

Description of mandatory standard requirements for admission: admission is granted upon applications of applicants who have completed secondary, specialized secondary education in full on a competitive basis in accordance with the scores of the certificate issued by the results of the unified national testing with a minimum score of not less than 65 points.

Special requirements for admission to the educational program, including for graduates of 12-year schools, colleges of applied bachelor programs, etc.: the presence of subject-specific and interdisciplinary competencies is provided through the implementation of requirements for general education and education in basic and profile cycles of academic disciplines, social, economic and organizational and management, professional competencies. Adjustment of subject-specific and interdisciplinary competencies is carried out in accordance with the findings of regular monitoring of the curricula results.

Rules for the transfer of credits for accelerated (part-time) training based on 12 years of secondary, secondary technical and higher education

Code	Competence type	Competence description	Competence result	Responsible
GENERAL (Implies full training with possible additional training depending on the level of knowledge)				
G1	Communicative	- Fluent monolingual oral, written, and communication skills - Ability to non-fluent communicate in a second language - Ability to use communicative skills in a variety of situations - Having the basics of academic writing in the native language - Language level diagnostic test	Full 4-year degree with a minimum of 240 academic credits (including 120 contact classroom academic credits) with possible transfer of credits for a second language where students have an advanced level. The language level is determined by a diagnostic test.	Department of Kazakh and Russian, Department of English
G2	Mathematical	- Basic mathematics problem solving at the communication level - Ability to solve situational problems on the basis of the mathematical apparatus of Algebra and Pre-calculus - Diagnostic test for quantitative literacy in algebra	Full 4-year degree with a minimum of 240 academic credits (including 120 contact classroom academic credits). At positive passing of the diagnostic test, level of Mathematics 1, at negative - Algebra and Pre-calculus.	Mathematics Department

G3	Basic literacy in science disciplines	- Basic understanding of the scientific worldview with an understanding of the essence of the basic laws of science - Understanding of basic hypotheses, laws, methods, formulation of conclusions and estimation of errors	Full 4-year degree with a minimum of 240 academic credits (including 120 contact classroom academic credits). At positive passing of the diagnostic test, level of Physics 1, General chemistry, at negative - Fundamentals of Physics and Elementary Chemistry.	Departments in science disciplines
SPECIFIC (implies accelerated training by transfer of credits based on competency level for graduates of 12-year schools, colleges, and universities, including liberal arts and economics majors)				
S1	Communicative	- Fluent bilingual oral, written, and communication skills - Ability to non-fluent communicate in third language - Writing skills in a variety of styles and genres - Profound comprehension and interpretation skills of one's own work of a certain level of complexity (essays) - Basic aesthetic and theoretical literacy as a condition for full perception, interpretation of the original text	Full transfer of credits in languages (Kazakh and Russian)	Department of Kazakh and Russian, Department of English
S2	Mathematical	- Special quantitative literacy using induction and deduction, generalization and concretization, analysis and synthesis, classification and systematization, abstraction and analogy - Ability to formulate, justify and prove statements - Application of general mathematical concepts, formulas, and extended spatial perception to mathematical problems - Full understanding of the fundamentals of calculus	Full transfer of credits in Calculus I discipline	Mathematics Department
S3	Special literacy in natural science disciplines	- Broad scientific perception of the world, involving a deep understanding of natural	Transfer of credits in Physics I, General Chemistry, General Biology,	Departments in natural science

	(Physics, Chemistry, Biology, Geography)	phenomena - Critical awareness to understand scientific phenomena of the natural world - Cognitive ability to articulate a scientific understanding of forms of substances, their interactions, and their manifestations in nature	Introduction to Geology, Introduction to Geodesy; Academic training, etc.	disciplines
S4	English	- Readiness for further self-study in English in various fields of knowledge - Readiness to gain experience in project and research work using English	Transfer of credits in English language above the level of academic to professional (up to 15 credits)	Department of English
S5	Computer skills	- Basic programming skills in one modern language - Use of software and applications for learning in a variety of disciplines - Availability of a globally standardized language certificate	Transfer of credits in the discipline Introduction to Information and Communication Technologies, Information and Communication Technologies	Department of Software Engineering
S6	Social humanities competencies and behavior	- Understanding and appreciation of each citizen's responsibility for the development of the country and the world - Ability to discuss ethical and moral issues in society, culture, and science	Transfer of credits in Contemporary History of Kazakhstan (excluding the state exam)	Department of social disciplines
		- Critical understanding and ability to engage in polemics to debate contemporary scientific hypotheses and theories	Transfer of credits in philosophy and other humanities disciplines	
PROFESSIONAL (implies accelerated training at the expense of transfer of credits depending on the level of knowledge in competences for graduates of colleges, AU schools, universities, including humanitarian and economic fields)				
P1	Professional competencies	- Critical awareness and deep understanding of professional competencies at level 5 or 6 - Ability to discuss and debate professional issues within the framework of the mastered program	Transfer of credits in basic professional disciplines, including specialty introductory course, structure and design of systems and machines by industry, maintenance of machines by industry,	Graduation department

			training and academic-industrial practice	
P2	General engineering competencies	- Basic general engineering skills and knowledge, ability to solve general engineering tasks and problems - Ability to use applied software packages for processing experimental data, solving systems of algebraic and differential equations	Transfer of credits in general engineering disciplines (Engineering Graphics, Descriptive Geometry, Fundamentals of Mechanics, Fundamentals of Hydrodynamics, Fundamentals of Electrical Engineering, Fundamentals of Microelectronics, Fundamentals of Thermodynamics, Fundamentals of Geology, etc.)	Graduation department
P3	Engineering and computer competencies	- Basic skills of using computer programs and software systems to solve general engineering problems	Transfer of credits in the following disciplines - Computer Graphics, Fundamentals of CAD, Fundamentals of CAE, etc.	Graduation department
P4	Engineering and operational competences	- Skills and abilities to use technical tools and experimental devices to solve general engineering problems	Transfer of credits in the academic disciplines of experimental areas: turning and locksmith work, repair work, welding, laboratory or analytical chemistry, laboratory physics, mineralogy, etc.	Graduation department
P5	Social and economic competences	- Critical understanding and cognitive ability to speculate on contemporary social and economic issues - Basic understanding of economic evaluation of research objects and profitability of industry projects	Transfer of credits in socio-humanitarian and technical-economic disciplines to the credit of the elective cycle	Graduation department

The university may deny transfer of credits if a low diagnostic level is confirmed or if the final grades in the courses completed are below A and B.

3 Requirements for completion of training and diploma

Description of General Standard Requirements for graduation and completion of a Bachelor's Degree: mastering at least 240 academic credits of theoretical study and final thesis.

Special requirements for graduation in this program:

- performance and defense of an interdisciplinary project in the area of study.
- the student shall have a general idea of the topic of the thesis, and contact potential supervisors one year before the expected completion of studies;
- compulsory completion of an internship on the topic of the diploma thesis;
- upon completion of the internship, the student shall contact the supervisor in writing or verbally and report the results of the work, but no more than one week after the beginning of the 4th year of study;
- within 4 weeks after the beginning of study, student and supervisor shall discuss and decide on the type (research, project or independent study) and topic of diploma thesis (this is an extremely important discussion and decision, as further change of topic and type of work is impossible);

4 The working curriculum of the educational program

SATBAYEV UNIVERSITY

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
SATBAYEV UNIVERSITY

APPROVED
Rector of Satbayev University
S.K. Beisembetov
"__" _____ 2020

MAJOR CURRICULUM for 2020-2021 academic year admission
Educational program 6B07109 - "Engineering physics and materials science"
Group of Educational program B061 – "Materials Science and Technology"

Full-time study Study duration : 4 years Academic degree: bachelor of Natural Sciences

Grade level	Code	Name of disciplines	Cycle	Total volume in credits	Classroom volume lec/lab/pr	Reload code	Prerequisite
		Term 1 (Autumn 2020)					
1	LNG 1053	Beginner (A1)	G	8	0/0/3/3	54	Diagnostic test
	LNG 1052	Elementary English (A1)					
	LNG 1053	General English 1 (A2)					
	LNG 1054	General English 2 (A2)					
	LNG 1055	Academic English (B1)					
	LNG1056	Business English (B2)					
	LNG1012	Kazakh/Russian (A2)					
	LNG1012.1	Academic Kazakh/Russian (B1)	G	4	0/0/2/2	51	Diagnostic test
	LNG1012.2	Business Kazakh/Russian (B2)					
	AAP106	Physical education I	G	4	0/0/2/2	no	no
	MAT00110	Algebra & Calculus Begin	B	6	1/0/2/3	52	Diagnostic test
	MAT101	Calculus I					
	PHY00110	Physics Begin	B	6	1/1/1/3	53	Diagnostic test
	PHY413	Physics I: Mechanics. Molecular Physics and Thermodynamics					
	CHE101	Fundamental basis of chemistry	B	6	1/1/1/3	no	Diagnostic test
	CHE102	Chemistry					
	HUM113	Contemporary History of Kazakhstan	G	6	1/0/2/3	38	no
		Total:		38	19		
		Term 2 (Spring 2021)					
	LNG 1052	Elementary English (A1)	G	8	0/0/3/3	54	LNG 1051
	LNG 1053	General English 1 (A2)					LNG 1052
	LNG 1054	General English 2 (A2)					LNG 1053
	LNG 1055	Academic English (B1)					LNG 1054
	LNG1056	Business English (B2)					LNG 1055
	LNG 1057	Professional English (B2+)					LNG1056
	LNG1012.1	Academic Kazakh/Russian (B1)	G	8	0/0/3/3	53	LNG10121
	LNG1012.2	Business Kazakh/Russian (B2)					LNG1012.1
	1001	ELECTIVE					LNG1012.2
	AAP118	Physical education II	G	4	0/0/2/2	no	no
	MAT101	Calculus I	B	6	1/0/2/3	no	MAT100
	MAT102	Calculus II					MAT101
	PHY413	Physics I: Mechanics. Molecular Physics and Thermodynamics	B	6	1/1/1/3	no	PHY00110
	PHY414	Physics II: Electricity and Magnetism					PHY413
	CHE102	Chemistry	B	6	1/1/1/3	no	CHE101
	1002	ELECTIVE					
	GDN101	Engineering and Computer Graphics	B	6	1/0/2/3	no	no
		Total:		46	28		
2		**Term 3 (Autumn 2021)**					
	LNG 1053	General English 1 (A2)	G	8	0/0/3/3	no	LNG 1052
	LNG 1054	General English 2 (A2)					LNG 1053
	LNG 1055	Academic English (B1)					LNG 1054
	LNG1056	Business English (B2)					LNG 1055
	LNG 1057	Professional English (B2+)					LNG1056
	MAT102	Calculus II	B	6	1/0/2/3	no	MAT101
	MAT103	Calculus III					MAT102
	CSE374	Information & Communication Technologies	G	6	2/0/1/3	55	no
	PHY414	Physics II: Electricity and Magnetism	B	6	1/1/1/3	no	PHY413
	PHY455	Physics III: Optics. Quantum physics. Atomic physics	B		1/1/1/3	no	PHY414
	PHY423	Physics of Matter (Introduction to the Specialty)	B	6	2/1/1/3	no	no
	PHY245	Quantum Mechanics	M	6	2/0/1/3	no	no
		Total:		26	18		
		Term 4 (Spring 2022)					
	LNG 1054	General English 2 (A2)	G	6	0/0/3/3	no	LNG 1053
	LNG 1055	Academic English (B1)					LNG 1054
	LNG1056	Business English (B2)					LNG 1055
	LNG 1057	Professional English (B2+)					LNG1056
	2001	ELECTIVE					LNG 1057
	MAT103	Calculus III	B	6	1/0/2/3	no	MAT102
	MAT126	Ordinary Differentiation Equations MatLab					MAT103
	HUM130	Social & Political Knowledge	G	8	4/0/0/4	56	no
	HUM124	Phylosophy	G	6	1/0/2/3	55	no
	PHY455	Physics III: Optics. Quantum physics. Atomic physics	B	6	1/1/1/3	no	PHY414
	2002	ELECTIVE	B				
	PHY122	Physical Materials	M	6	2/1/0/3	no	no
	PHY263	Statistical Physics and Thermodynamics	M	6	2/0/1/3	no	no
		Total:		44	22		
3		**Term 5 (Autumn 2022)**					
	MAT126	Ordinary Differentiation Equations MatLab	B	8	1/0/2/3	no	MAT103
	MAT127	Partial Differentiation Equations Matlab					MAT126
	PHY106	Condensed Matter Physics	B	6	1/1/1/3	no	PHY349
	PHY245	Functional Materials	M	6	1/0/2/3	no	no
	PHY178	Computational Physics	M	6	1/0/2/3	no	no
	PHY437	Modern Materials Research Methods	M	6	1/1/1/3	no	no
	3001	ELECTIVE	B	6			
		Total:		36	18		
		Term 6 (Spring 2023)					
	MAT127	Partial differential equations. Matlab	B	6	1/0/2/3	no	MAT126
	3002	ELECTIVE					
	AUT146	Basics of Automation	B	6	2/1/0/3	P1-3	PHY414
	PHY438	Fundamentals of Heat Treatment and Surface Hardening	M	6	1/1/1/3	no	no
	PHY440	Non-Metallic Materials and Technologies	M	6	1/1/1/3	no	no
	PHY161	Physics of Semiconductor Devices	M	6	1/1/1/3	no	no
	3003	ELECTIVE	B	6			
		Total:		36	18		
4		**Term 7(Autumn 2023)**					
	4005	ELECTIVE	M	6		no	
	4002	ELECTIVE	M	6		no	
	4003	ELECTIVE	M	6		no	
	4004	ELECTIVE	M	6		no	
	ECA101	Preparation & writing of thesis (project)	FA	4			
		Total:		28	12		
		Term 8. (Spring 2024)					
	4006	ELECTIVE	M	6		no	
	4006	ELECTIVE	M	6		no	
	4007	ELECTIVE	B	6		no	
	ECA101	Preparation & writing of thesis (project)	FA	4			
	ECA102	Thesis (project) defence	FA	6			
		Total:		28	9		

Additional academic programmes (AAP)

Year of study	Code	Name of discipline	Credits	Semester
2	AAP122,332	Physical education	0	3-4
1	AAP103	Internship	2	2
2	AAP109	Industrial Internship I	2	4
3	AAP109	Industrial Internship II	4	6
2-3	AAP300	Military training	0	3-6

Total number of credits

Cycle of disciplines	Credits: comp.	Credits: elective	Credits: total
Cycle of general disciplines (G)	58	10	68
Cycle of basic disciplines (B)	78	36	114
Cycle of special disciplines (S)	58	36	94
Total of theoretical study:	190	82	272
Additional Education	8	0	8
Final Attestation (FA)	14	0	14
Total:	22	0	22
Classroom Volume in Theoretical Training Credits:	95	41	136

Decision of the Academic Council Satbayev University. Minutes № 3 , dated "15" 09. 2020 y.

Decision of the Educational and Methodological Board of Satbayev University. Minutes № 4, dated "14" 01. 2020 y.

Decision of the Academic Council of the School of MIE. Minutes № 10 dated 25 09 2020.

Vice-rector for academic affairs — R.M. Iskakov

Chairman of Academic Planning Committee — K.B. Tulegenova

Director of the School of Metallurgy and Industrial Engineering — S.K.Yelemessov

Head of "Engineering Physics" department — K.T. Beisenov

СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

SATBAYEV UNIVERSITY

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
SATBAYEV UNIVERSITY

APPROVED
Rector of Satbayev University
________ I.K. Beisembetov
________ 2020

MAJOR CURRICULUM for 2020-2021 academic year admission
Educational program 6B07207 - " Engineering physics and materials science"
Group of Educational program B069 - " Production of materials (glass, paper, plastic, wood)"

Full-time study | Study duration : 4 years | Academic degree: bachelor of Natural Sciences

Grade level	Code	Name of disciplines	Cycle	Total volume in credits	Classroom volume lec/lab/pr	Reload code	Prerequisite
		Term 1 (Autumn 2020)					
1	LNG 1051	Beginner (A1)	G	6	0/0/3/3	54	Diagnostic test
	LNG 1052	Elementary English (A1)					
	LNG 1053	General English 1 (A2)					
	LNG 1054	General English 2 (A2)					
	LNG 1055	Academic English (B1)					
	LNG1056	Business English (B2)					
	LNG1012	Kazakh/Russian (A2)	G	4	0/0/2/3	51	Diagnostic test
	LNG1012.1	Academic Kazakh/Russian (B1)					
	LNG1012.2	Business Kazakh/Russian (B2)					
	AAP106	Physical education I	G	4	0/0/2/7	no	no
	MAT00110	Algebra & Calculus Begin	B	6	1/0/2/3	52	Diagnostic test
	MAT101	Calculus I					
	PHY00110	Physics Begin	B	6	1/1/1/3	53	Diagnostic test
	PHY413	Physics I: Mechanics. Molecular Physics and Thermodynamics					
	CBI101	Fundamental bases of chemistry	B	6	1/1/1/3	no	Diagnostic test
	CHE192	Chemistry					
	HUM113	Contemporary History of Kazakhstan	G	6	1/0/2/3	56	no
		Total:		38	19		
		Term 3 (Autumn 2021)					
2	LNG 1053	General English 1 (A2)	G	6	0/0/3/3	no	LNG 1052
	LNG 1054	General English 2 (A2)					LNG 1053
	LNG 1055	Academic English (B1)					LNG 1054
	LNG1056	Business English (B2)					LNG 1055
	LNG 1057	Professional English (B2+)					LNG1056
	MAT102	Calculus II	B	6	1/0/2/3	no	MAT101
	MAT103	Calculus III					MAT102
	CSE176	Information & Communication Technologies	G	6	2/0/1/3	55	no
	PHY414	Physics II: Electricity and Magnetism	B	6	1/1/1/3	no	PHY413
	PHY455	Physics III: Optics. Quantum physics. Atomic physics.	B		1/1/1/3	no	PHY414
	PHY421	Physics of Matter (Introduction to the Specialty)	B	6	1/1/1/3	no	no
	PHY149	Quantum Mechanics	M	6	2/0/1/3	no	no
		Total:		36	18		
		Term 5 (Autumn 2022)					
3	MAT126	Ordinary Differentiation Equations MatLab	B	6	1/0/2/3	no	MAT103
	MAT127	Partial Differentiation Equations MatLab					MAT126
	PHY196	Condensed Matter Physics	B	6	1/1/1/3	no	PHY149
	PHY245	Functional Materials	M	6	1/0/2/3	no	no
	PHY178	Computational Physics	M	6	1/0/2/3	no	no
	PHY437	Modern Materials Research Methods	M	6	1/1/1/3	no	no
	3001	ELECTIVE	B	6			
		Total:		36	18		
		Term 7 (Autumn 2023)					
4	4001	ELECTIVE	M	6		no	
	4002	ELECTIVE	M	6		no	
	4003	ELECTIVE	M	6		no	
	4004	ELECTIVE	M	6		no	
	ECA101	Preparation & writing of thesis (project)	FA	4			
		Total:		28	12		

Code	Name of disciplines	Cycle	Total volume in credits	Classroom volume lec/lab/pr	Reload code	Prerequisite
	Term 2 (Spring 2021)					
LNG 1052	Elementary English (A1)	G	6	0/0/3/3	54	LNG 1051
LNG 1053	General English 1 (A2)					LNG 1052
LNG 1054	General English 2 (A2)					LNG 1053
LNG 1055	Academic English (B1)					LNG 1054
LNG1056	Business English (B2)					LNG 1055
LNG 1057	Professional English (B2+)					LNG1056
LNG1102.1	Academic Kazakh/Russian (B1)	G	6	0/0/3/3	51	LNG10121
LNG1102.2	Business Kazakh/Russian (B2)					LNG1012.1
1001	ELECTIVE					LNG1012.2
AAP118	Physical education II	G	4	0/0/2/2	no	no
MAT101	Calculus I	B	6	1/0/2/3	no	MAT100
MAT102	Calculus II					MAT101
PHY413	Physics I: Mechanics. Molecular Physics and Thermodynamics	B	6	1/1/1/3	no	PHY00110
PHY414	Physics II: Electricity and Magnetism					PHY413
CHE192	Chemistry	B	6	1/1/1/3	no	CBI101
1002	ELECTIVE					
GEN101	Engineering and Computer Graphics	B	6	1/0/2/3	no	no
	Total:		40	20		
	Term 4 (Spring 2022)					
LNG 1054	General English 2 (A2)	G	6	0/0/3/3	no	LNG 1053
LNG 1055	Academic English (B1)					LNG 1054
LNG1056	Business English (B2)					LNG 1055
LNG 1057	Professional English (B2+)					LNG1056
2001	ELECTIVE					LNG 1057
MAT103	Calculus III	B	6	1/0/2/3	no	MAT102
MAT126	Ordinary Differentiation Equations Matlab					MAT103
HUM130	Social & Political Knowledge	G	8	4/0/0/4	58	no
HUM124	Philosophy	G	6	1/0/2/3	56	no
PHY455	Physics III: Optics. Quantum physics. Atomic physics.	B	6	1/1/1/3	no	PHY414
2002	ELECTIVE	B				
PHY122	Physical Materials	M	6	2/1/0/3	no	no
PHY163	Statistical Physics and Thermodynamics	M	6	2/0/1/3	no	no
	Total:		44	22		
	Term 6 (Spring 2023)					
MAT127	Partial differential equations. Matlab	B	6	1/0/2/3	no	MAT126
3002	ELECTIVE					
AUT146	Basics of Automation	B	6	2/1/0/3	PS-3	PHY414
PHY438	Fundamentals of Heat Treatment and Surface Hardening	M	6	1/1/1/3	no	no
PHY440	Non-Metallic Materials and Technologies	M	6	1/1/1/3	no	no
PHY161	Physics of Semiconductor Devices	M	6	1/1/1/3	no	no
3003	ELECTIVE	B	6			
	Total:		36	18		
	Term 8 (Spring 2024)					
4005	ELECTIVE	M	6		no	
4006	ELECTIVE	M	6		no	
4007	ELECTIVE	B	6		no	
ECA101	Preparation & writing of thesis (project)	FA	4			
ECA102	Thesis (project) defence	FA	6			
	Total:		28	9		

Additional academic programes (AAP)

Year of study	Code	Name of discipline	Credits	Semester
1	AAP122,132	Physical education	0	3-4
1	AAP101	Internship	2	2
2	AAP109	Industrial internship I	2	4
3	AAP103	Industrial internship II	4	6
2-3	AAP500	Military training	0	3-6

Total number of credits

Cycle of disciplines	Credits: compulsary	Credits: elective	Credits: total
Cycle of general disciplines (G)	58	10	68
Cycle of basic disciplines (B)	78	36	114
Cycle of special disciplines (S)	54	36	90
Total of theoretical study:	190	82	272
Additional Education	8	0	8
Final Attestation (FA)	14	0	14
Total:	22	0	22
Classroom Volume in Theoretical Training Credits	95	41	136

Decision of the Academic Council Satbayev University. Minutes № 3 , dated "15" 09. 2020y.

Decision of the Educational and Methodological Board of Satbayev University Minutes № 4, dated "14" 01. 2020y.

Decision of the Academic Council of the School of MIE. Minutes № 1, dated "5" 08 2020

Vice-rector for academic affairs — R.M. Iskakov

Chairman of Academic Planning Committee — K.B. Tulegenova

Director of the School of Metallurgy and Industrial Engineering — K.K.Yelemessov

Head of "Engineering Physics" department — R.E. Beisenov

5 Descriptors of the level and scope of knowledge, abilities, skills and competencies

A - knowledge and understanding:

A1 - forms and types of cultures, regularities of their functioning and development, history of culture of Kazakhstan;

A2 - basic sources of emergence and development of mass social movements, factors of social development

A3 - ethical legal norms regulating individual's relationship to the individual, society, the environment;

A4 - about modern achievements of natural sciences, physical principles of operation of modern technical devices;

A5 - about mathematics as a special way of perceiving the world, the generality of its concepts and notions;

A6 - about information, methods of its storage, development and transfer.

B - application of knowledge and understanding

B1 - general principles and regularities of natural processes and phenomena from macro to nano scales; basic principles, methods of investigation and modelling of surface, structure and properties of materials of different dimensions in modern production conditions

B2 - probe technologies; electro-physical, optical, quantum devices; spectroscopic, X-ray, analytical equipment, technical means of space branch, computer engineering and means of automated information processing; vacuum engineering;

B3 - matters of labor protection and safety engineering, basics of law and environmental legislation, basics of patenting and scientific organization of work; independent development and presentation of various options for solving professional problems with the application of theoretical and practical knowledge;

C - formation of judgments

C1 - in methods of implementation of basic technical and technological processes of research, study, processing, modeling and formation of materials;

C2 - in experimental methods of study of materials, in analytical methods of information processing, in methods of calculation of technical and technological parameters of production;

C3 - in modern technologies for obtaining materials to solve priority problems of production.

D - personal abilities

D1 - Have broad fundamental knowledge, be proactive, have the ability to adapt to the changing requirements of the labor market and technology, able to work in a team;

D2 - Know the ethical and legal norms governing human relations with the individual, society, the environment, be able to take them into account when developing environmental and social projects;

D3 - Be able to apply one's knowledge and understanding in a way that is customary in the relevant professional field and have competencies manifested in the ability to construct arguments and make decisions in one's field of knowledge;

D3 - Be prepared to solve professional problems in accordance with the training profile;

D4 - Be capable of organizing and managing research work in contemporary conditions.

6 Competencies for completion of training

- programming (Engineering physics, Materials science): possess modern system of subject knowledge in the field of development of projects of fulfillment of specific professional tasks, etc.;

- interdisciplinary (Nanotechnology, Nuclear Technology, Space Technology, Quantum Electronics): possess knowledge in the field of development of related sciences and about modern needs of production industries in materials and technologies; about methods and ways of mathematical processing of experimental and literature data on promising materials and alternative technologies; about fundamental knowledge of physics, chemistry, biology.

B - Basic knowledge and skills

B1 - work with electrophysical, optical, quantum instruments, spectroscopic, x-ray, analytical, etc. equipment,

B2 - proficient in analytical processing of measurement data;

B3 - proficient in software products.

P - Professional competences, including those according to the requirements of industry professional standards (*if any*)

P1 - extensive range of theoretical and practical knowledge in the professional field, performance of production-technological types of professional activity;

P2 - performance of engineering tasks in the development of materials, devices, techniques, technologies by branch; conduct necessary research and measurements, using high-tech equipment; analyze and interpret obtained data, draw conclusions;

P3 - use the rules of safety and labor protection in the conditions of production activity.

O - Universal, social and ethical competencies

O1 - Ability to be guided by ethical and legal standards;

O2 - Ability to work in an international context;

O3 - Willingness to be aware of the social importance of one' s future profession, self-development, professional development;

O4 - Ability to analyze socially significant processes and phenomena, to participate responsibly in social and political life.

S - Special and managerial competencies

S1 - competence in production and management, design and engineering, organizational and technological and scientific-pedagogical fields on the basis of modern training means of information technology and information resources.

S2 - ability to perform professional functions within one or more activities on the basis of learning outcomes that take into account the specifics of these activities, market requirements for organizational, managerial and professional competencies.

7 Supplement to the diploma under the ECTS standard

Bachelor of Engineering and Technology, Level 6 of the National Qualifications Framework.

Physics of matter (Specialty introductory course).
CODE - (not available)
CREDIT- 6 (1/1/1)
PREREQUISIT – none

COURSE GOALS AND OBJECTIVES
The goal of the **Physics of matter (Specialty introductory course)** course is a systematic presentation of the regularities of change in the composition, structure and properties of matter depending on its aggregate state and external conditions; expansion of knowledge about the structure of matter.
COURSE SUMMARY
Physics of matter (Specialty introductory course) discipline considers the fundamental aspects of physical and chemical behavior of gaseous, liquid and solid substances, forms the basic concepts and ideas of condensed matter physics for the application of this knowledge in various fields of science and technology.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Shall know: basic types of condensed matter, symmetric classification of crystal lattices, basic types of structural defects, elements of elasticity theory, basic processes occurring in crystals.
Shall have the skills: to determine the structure of simple lattices, to work with laboratory equipment and modern scientific equipment.
Shall have the abilities: to conduct a physical experiment.

Algebra and Pre-calculus
CODE – MAT00120
CREDIT – 3 (1/0/2)
PREREQUISIT – diagnostic test

COURSE GOALS AND OBJECTIVES
Goal of the course - to introduce students to the basic ideas and concepts of algebra and mathematical analysis and the formation of basic knowledge necessary for the study of the course "Calculus 1".
Objectives of the course - formation of skills for the study of mathematical disciplines and the effective use of mathematical methods for research and practical problems in the professional field.

COURSE SUMMARY
"Algebra and Pre-calculus" courses provide the basic concepts of algebra, mathematical analysis, differential and integral calculus.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Shall know:
- basic concepts of algebra;
- basic concepts of mathematical analysis;
- basic elementary functions;

Shall have the skills:
- to determine solutions to equations and inequalities, systems of equations and inequalities;
- to transform algebraic and trigonometric expressions;
- to solve text problems;
- to determine the derivative of elementary functions;
- to analyze functions using the derivative;
- to determine an indefinite integral of elementary functions;
- to determine a definite integral;
- to determine the area of a curvilinear trapezoid.

Calculus I
CODE – MAT00121
CREDIT – 3 (1/0/2)
PREREQUISIT – Elementary mathematics - school course/diagnostic test

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COURSE GOALS AND OBJECTIVES
Main goal of the course is to provide the future specialist with a certain amount of knowledge on the sections of the course "Mathematics-!", necessary for the study of related engineering disciplines. To introduce students to the ideas and concepts of mathematical analysis. Focus on the formation of basic knowledge and skills with a high degree of their understanding of differential and integral calculus.
Course objectives:
Acquiring the knowledge necessary for the effective use of rapidly developing mathematical methods; acquiring the skill of constructing and investigating mathematical models; mastery of the fundamental sections of mathematics necessary to solve research and practical problems in the professional field.

COURSE SUMMARY
Calculus I course provides an outline of the following sections: introduction to analysis, differential and integral calculus.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
The study of the above discipline will allow the student to apply the Calculus I course to solve simple practical problems, to find tools sufficient for their research, and to obtain numerical results in some standard situations.

Calculus II
CODE – MAT00122
CREDIT – 3 (1/0/2)
PREREQUISIT – Calculus I

COURSE GOALS AND OBJECTIVES

The goal of teaching Calculus II course is to form the bachelors' understanding of modern mathematics in general as a logically coherent system of theoretical knowledge. **Course objectives** - to equip students with solid skills of solving mathematical problems with bringing the solution to a practically acceptable result. Develop the primary skills of mathematical research of applied problems and the ability to independently understand the mathematical apparatus contained in the literature related to the specialty of the student.

COURSE SUMMARY

Calculus II course provides an accessible presentation of the following sections: elements of linear algebra and analytic geometry, differential calculus of functions of many variables, and multiple integrals. "Calculus II" is a logical continuation of the course "Calculus I".

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

Studying of the specified discipline will allow applying in practice the received theoretical knowledge and skills with a high degree of their understanding on sections of course, to use them at an appropriate level; to translate in the mathematical language the elementary problems put in terms of other subject fields; to acquire new mathematical knowledge, using educational and information technologies; to solve applied problems in the field of professional activity.

Calculus III
CODE – MAT00123
CREDIT – 3 (1/0/2)
PREREQUISIT – Calculus I, Calculus II

COURSE GOALS AND OBJECTIVES

The goal of teaching Calculus III course is to form basic knowledge and skills with a high degree of understanding of the sections of the course, aiding to analyze and solve theoretical and practical problems.

Course objectives - to equip students with the ability to independently study the academic literature, conduct theoretical and statistical analysis of applied problems; to develop logical thinking and increase the general level of mathematical culture.

COURSE SUMMARY

Calculus III course includes the following sections: theory of series, elements of probability theory and mathematical statistics and is a logical extension of the course "Calculus II".

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

Shall know:

- the theory of numerical series;
- the theory of functional series;
- Fourier series;
- elements of probability theory and mathematical statistics;

Shall have the skills:

- to solve problems in all sections of series theory;
- to determine probabilities of events;
- to determine the numerical characteristics of random variables;
- to use statistical methods for processing experimental data;

Physics I: Mechanics. Molecular Physics and Thermodynamics, Physics II: Electricity and Magnetism, Physics III: Optics. Atomic physics.
CODE - PHYS413, PHYS414, PHYS415
CREDIT - 6 (1/1/1)
PREREQUISITE - none

COURSE GOALS AND OBJECTIVES

The main goal of teaching the courses "Physics I: Mechanics. Molecular Physics and Thermodynamics, Physics II: Electricity and Magnetism, Physics III: Optics. Atomic physics." consists in formation of representations about the modern physical idea of the world and a scientific outlook.

COURSE SUMMARY

The disciplines of "Physics I: Mechanics. Molecular Physics and Thermodynamics, Physics II: Electricity and Magnetism, Physics III: Optics. Atomic physics." represent the basis of theoretical training and engineering and technical activities of higher technical school graduates and constitute the core of physical knowledge necessary for an engineer operating in the world of physical laws. The course of "Physics I: Mechanics. Molecular Physics and Thermodynamics" includes the following sections: physical fundamentals of mechanics, structure of matter and thermodynamics. The discipline of "Physics II: Electricity and Magnetism" is a logical extension of the discipline of "Physics I: Mechanics. Molecular Physics and Thermodynamics" and forms a complete picture of the course of general physics as one of the basic components of the general theoretical training of bachelors in engineering and technology. The discipline of "Physics III: Optics. Atomic physics" includes the following sections: optics, nanostructures, basics of quantum physics, theory of relativity, atomic physics.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
- Skills to use knowledge of fundamental laws, theories of classical and modern physics, as well as the use of methods of physical research as the basis of the system of professional activity.

Modern History of Kazakhstan
CODE – HUM113
CREDIT - 3 (1/0/2)
PREREQUISITE - none

COURSE GOALS AND OBJECTIVES

The goal of the course is to introduce students of technical specialties with the main theoretical and practical achievements of domestic historical science on the history of modern Kazakhstan, a comprehensive and systematic study of the main stages of formation and development of the Kazakhstan society.

- to analyze the peculiarities and contradictions of the history of Kazakhstan during the Soviet period;
- to reveal the historical content of the basic laws of political, socio-economic, cultural processes at the stages of formation of an independent state
- to contribute to the formation of students' civil position;
- to educate students in the spirit of patriotism and tolerance, involvement with their nation and homeland;

COURSE SUMMARY

The course of Contemporary History of Kazakhstan is an independent discipline and covers the period from the beginning of the twentieth century to the present day. Contemporary History of Kazakhstan studies the national liberation movement of Kazakh intelligentsia in the early twentieth century, the period of the establishment of the Kazakh ASSR, as well as the process of formation of a multinational society.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

- knowledge of events, facts and phenomena of the modern history of Kazakhstan;
- knowledge of the history of ethnic groups populating Kazakhstan;
- knowledge of the basic stages of formation of the Kazakh statehood;
- ability to analyze complex historical events and to predict their further development
- ability to work with all kinds of historical sources;
- ability to write essays and scientific articles on the history of the homeland;
- ability to operate with historical notions;
- ability to conduct discussion;
- ability to independently analyze historical facts, events and phenomena;
- public speaking skills.

Kazakh/Russian language
CODE – LNG1012-1102.1
CREDIT – 4 (0/0/4)
Prerequisite - diagnostic test

PURPOSE AND OBJECTIVES OF THE COURSE

- to teach students to comprehend statements on well-known topics related to home, study, leisure time;
- to understand texts on personal and professional topics containing the most common words and expressions;
- to be able to speak on everyday topics; describe your experiences; tell your opinion; retell and evaluate the content of the book read, the film seen;
- to be able to create simple texts on well-known topics, including those related to professional activities.

SUMMARY OF THE COURSE

The language material of the course is selected in such a way that the student, assimilating the lexical and grammatical minimum, has the opportunity to get acquainted with typical communicative situations and if he found himself in such situations, he would be able to correctly evaluate them and choose the appropriate model (strategy) of speech behavior. At the same time, the main emphasis of teaching is transferred from the process of transferring knowledge to teaching the ability to use the target language, during the implementation of various types of speech activities, which are reading (providing reading comprehension), listening (under the same condition) and the production of texts of a certain complexity with a certain degree of grammatical and lexical correctness.
The material for classes is selected so that students, while studying the Kazakh / Russian language, acquire the skills of reading, writing and understanding the speech based on the simultaneous mastering of the basics of grammar (phonetics, morphology and syntax) and word usage in the course of constant repetition with a gradual complication of tasks.

KNOWLEDGE, SKILLS, ABILITIES AT THE END OF THE COURSE

Providing active organization of work in the classroom and conscientious completion of homework, a student by the end of the first semester acquires skills and abilities corresponding to the European level A2 (Threshold according to ALTE classification), that is, he is on the threshold of the level of autonomous language proficiency.

English
CODE – LNG1051-1057
CREDIT – 12 (0/0/12)
Prerequisite - diagnostic test/ LNG1051-1056

LNG1051
PURPOSE AND OBJECTIVES OF THE COURSE
The "Beginner English" course is designed primarily for start-up learning. This course is also suitable for those who have only general elementary knowledge of the language. After passing this level, the student will be able to confidently communicate on basic topics in English, learn the basics of grammar and lay a certain foundation that will allow him to improve his skills at the next stage of learning English. Course post-requisites: Elementary English.

LNG1052
PURPOSE AND OBJECTIVES OF THE COURSE
The "Elementary English" course is the foundation of English language learning, which is aimed at developing students' receptive skills (reading and listening) and productive skills (writing and speaking), analyzing basic knowledge, using and memorizing the main grammar rules and mastering the features of pronunciation and elementary vocabulary, and encouraging self-study and critical thinking.
Course prerequisites: Beginner.
Course post-requisites: General 1.

LNG1053
PURPOSE AND OBJECTIVES OF THE COURSE
The aim of “General English1” course is to provide students with the opportunity to acquire sufficient knowledge to become freer in their everyday social and academic settings. Students are working to improve pronunciation, vocabulary and grammar. At this level, the main task will be to consolidate the skills acquired earlier, to learn how to compose and correctly apply complex syntactic constructions in English, as well as to achieve really good pronunciation.
Course prerequisites: Elementary English.
Course post-requisites: General 2.

LNG1054
PURPOSE AND OBJECTIVES OF THE COURSE
The “General English 2” course is intended for students who continue to study “General English 1”. The course is focused on the ability to actively use in practice most aspects

of the tenses of English language, conditional sentences, passive phrases, etc. At this stage, the student will be able to maintain a conversation with several interlocutors or express his point of view. The student significantly expands his vocabulary, which will allow him to freely express his thoughts in any environment. In this case, speech will be replenished with various synonyms and antonyms of already familiar words, phrasal verbs and stable expressions.
Course prerequisites: General 1.
Course post-requisites: Academic English.

LNG1055
PURPOSE AND OBJECTIVES OF THE COURSE
The main goal of the "Academic English" course is to develop academic language skills. The discipline is a language style that is used when writing academic papers (paragraph, abstract, essay, presentation, etc.) This course is designed to help students become more successful and effective in their learning, developing critical thinking skills and independent learning.
Course prerequisites: General 2.
Course post-requisites: Professional English.

LNG1056
PURPOSE AND OBJECTIVES OF THE COURSE
"Business English" is English for business communication, business and career. Knowledge of business English is useful for negotiating and business correspondence, preparing presentations and informal communication with business partners.
The peculiarities of the training are that it is necessary not only to master the vocabulary, but also to master new skills: presentation, communication, language, professional.
Course prerequisites: IELTS score 5.0 and / or Academic English
Course post-requisites: Professional English, IELTS score 5.5-6.0

LNG1057
PURPOSE AND OBJECTIVES OF THE COURSE
The "Professional English" course is designed for B2 + level students, which aims to improve the language competence of students in their respective professional fields. The main goal of the course is to teach students to work with texts, both audio and written ones, in their specialty. The curriculum is built on the necessary vocabulary (words and terms), often used in English for specific purposes. Students will acquire professional English language skills through integrated content and language-based learning, master vocabulary in order to read and understand original sources with a great degree of independence, and practice different communication models and vocabulary in specific professional situations.

Course prerequisites: Business English.
Course post-requisites: any elective course.

Information and communication technologies (in English)
CODE –
CREDIT – 3 (2/1/0)
Prerequisite – no

PURPOSE AND OBJECTIVES OF THE COURSE

- Training the skills of applying modern information technologies in the field of professional activities. The objectives of the course include:
  - To reveal the basic concepts of the architecture of computer systems;
  - To reveal the basic concepts of information and communication technologies and subject terminology;
  - To teach how to work with program interfaces of operating systems;
  - To teach how to work with data in a different presentation, both tabular structured and unstructured form;
  - To teach how to apply the basic principles of information security;
  - To reveal the concepts of data formats and multimedia content. To teach how to work with typical applications for processing multimedia data. To use modern approaches to material presentation;
  - To reveal the concepts of modern social, cloud and email platforms and how to work with them;
  - To teach how to use algorithms and programming methods to solve problems of automating business processes

SUMMARY OF THE COURSE
The course contains a training program aimed at leveling the basic knowledge of students in the field of information and communication technologies. It contains a full range of topics, according to the Standard Curriculum of the State Educational Standard, with a predominance of training practical skills in working with data, algorithms and programming. The course is designed in such a way as to teach students not only the basic concepts of architecture and modern infrastructure of information and communication technologies, but also to teach how to use these tools to solve applied problems. To teach how to optimize processes, apply adequate models and methods for solving practical problems using modern methods and tools of information technology, automate routine processes, be productive and efficient.

KNOWLEDGE, SKILLS, ABILITIES AT THE END OF THE COURSE

Students will know:
• Computer structure;
• Architecture of computing systems;
• Infrastructure of information and communication technologies;
• Interfaces of modern operating systems;
• Modern tools for working with data of various nature and purpose;
• Types of information security threats, principles, tools and methods of data protection;
• Python programming language.
Students will be able to:
• Work with interfaces of modern operating systems;
• Work with modern application software for working with data of various nature and purpose;
• Apply modern social, cloud, email platforms to organize business processes;
• Program in an algorithmic programming language;
• Analyze, model, design, implement, test and evaluate information and communication technology systems

Philosophy
CODE – 124
CREDIT – 3 (1/0/2)
PREREQUISIT – Contemporary History of Kazakhstan

COURSE GOALS AND OBJECTIVES
The goal of the course is to form cognitive, operational, communicative, self-educational competencies to solve problems:

- to promote the development of adequate worldview reference points in the modern world;
- to form creative and critical thinking in students;
- to distinguish the relationship between spiritual and material values, their role in human life, society and civilization
- to promote the definition of their attitude to life and the search for harmony with the world around them.

COURSE SUMMARY
"Philosophy" is the formation of a holistic worldview, which developed in the context of socio-historical and cultural development of mankind. Familiarity with the main paradigms of the methodology of teaching philosophy and education in the classical and

post-classical traditions of philosophy. Philosophy is designed to develop sustainable life orientations, finding the meaning of one's existence as a special form of spiritual production. Contributes to the formation of the moral character of the individual with the ability to think critically and creatively. Theoretical sources for this course are the concepts of Western, Russian, Kazakh scientists on history and theory of philosophy.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

- knowledge of the basic terms, main concepts and problems of philosophy;
- knowledge of the main philosophical ways of solving worldview problems in the context of culture;
- ability to analyze the history of philosophical thought development;
- ability to identify alternative ways of posing and solving philosophical problems in the history of human development

- ability to identify the main theoretical approaches in the relationship between the individual and society;
- ability to master the methods of independent work;
- skills of searching and systematization of material;
- ability to freely discuss and make rational decisions;
- skills of ethical principles in professional activities.

Ordinary differential equations
CODE – MAT00124
CREDIT – 3 (1/0/2)
PREREQUISIT – Calculus I-III

COURSE GOALS AND OBJECTIVES

The goal of teaching the course "Ordinary differential equations. Matlab" is the formation of basic knowledge of the sections of the course, assisting in analyzing, modeling and solving theoretical and practical problems by both analytical and numerical methods using Matlab; instill in students the ability to study the academic literature independently. Course objectives are to teach students to recognize the types and forms of integrable equations and systems, to integrate them, and to apply differential equations to mathematical solutions of applied problems.

COURSE SUMMARY

Ordinary differential equations of the 1st order. Ordinary differential equations of higher orders. Systems of differential equations. Linear equations with variable coefficients. Numerical integration of differential equations and systems. Using Matlab for numerical solution of differential equations.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

- to master methods of solving ordinary differential equations;
- to set mathematical problems;
- to be able to construct mathematical models;
- to be able to solve problems, modeled by differential equations, using both analytical and numerical methods, by means of Matlab.

Partial differential equations
CODE – MAT00125
CREDIT – 3 (1/0/2)
PREREQUISIT – Calculus I-III

COURSE GOALS AND OBJECTIVES

The goal of teaching the course "Partial Differential Equations. Matlab" is the formation of basic knowledge of the sections of the course, assisting in analyzing, modeling and solving theoretical and practical problems.
Course objectives: to apply the theory of partial differential equations to solve and study applied problems from various fields of natural history, economics, medicine, biology and ecology; to form ideas on the implementation of numerical methods for solving boundary value problems using Matlab.

COURSE SUMMARY

Basic equations of mathematical physics. Classical boundary value problems for partial differential equations. Analytical and numerical methods for solving classical boundary value problems. Using Matlab for numerical solution of boundary value problems.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

- to master the mathematical apparatus necessary for analyzing, modeling and solving classical boundary value problems;
- to master the methods of solving classical boundary value problems;
- to be able to set the problem, to choose the methods of solution, both in analytical form and with the use of computer technologies;
- to be able to use modern software - package Matlab;
- to master the methodology and skills of numerical implementation of the mathematical model, analysis of the obtained results, their interpretation for model refinement;
- to independently extend one' s mathematical knowledge.

General Chemistry
CODE – CHE192
CREDIT – 3 (2/1/0)
PREREQUISIT – diagnostic test

COURSE GOALS AND OBJECTIVES
Goal of the course: Formation of knowledge on fundamental aspects of general chemistry and skills to apply them in professional activities.
Course objectives:

- To convey the basic theoretical knowledge of the chemistry course;
- To help students to get the skills to perform laboratory works;
- To teach them to solve typical problems and to describe the equations of reactions, which promotes the informal assimilation of the theoretical material;
- To form students' chemistry thinking skills.

COURSE SUMMARY
The course "General Chemistry" examines the laws, theoretical positions and conclusions that underlie all chemical disciplines, studies the properties and relationships of chemical elements based on the periodic law of D.I. Mendeleev and on modern ideas about the structure of matter, the basics of chemical thermodynamics and kinetics, processes in solutions, the structure of complex compounds.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
As a result of mastering the discipline the students shall
1) know:

- basic chemical laws and concepts,
- different chemical systems,

- basic regularities of chemical reactions,
- reactivity of substances based on the knowledge of the structure of atoms, the periodic system of elements and chemical bonding.

2) be able to:

- solve problems using the acquired knowledge,
- describe equations of reactions,
- make calculations using the basic chemical laws.

3) possess the skills to:

- navigate the basic concepts of chemistry, the properties of elements of nonmetals and metals groups of the periodic system;
- gain skills in formulating chemical equations, solving problems, explaining the properties of elements and their compounds on the basis of the laws of chemistry, conducting chemical experiments and explaining occurring phenomena.

Computational Physics
CODE – PHY178
CREDIT – 6 (1/0/2)
PREREQUISITES: PHY413 "Physics I", PHY414 "Physics II", MAT101 "Calculus I", MAT102 " Calculus II"

COURSE GOALS AND OBJECTIVES

- Mastering of the basic arsenal of modern numerical methods for solving physical problems for the work of theorists in the field of information modeling of real physical phenomena and processes, and for the experimentalists to understand the prospects of their application in their chosen field of specialization;
- Formation of a sustainable interest in the use of computer technologies for solving problems in various sections of physics and technology;
- Acquiring the skills of formulation, organization and analysis of the results of numerical experiment;
- Formation of the ability to organize own research and methodical work with the help of the computer;
- Raising the level of mathematical and algorithmic erudition by means of practical computer solutions of specially selected problems;
- Preparation for conscious and critical use of mathematical packages of applied programs;
- Nurturing the culture of physical formulation of problems of interdisciplinary nature and expanding knowledge of the tools of numerical methods.

COURSE SUMMARY

Mathematical modeling and computational experiment have essentially become equal branches of physics, along with the historically established division of this science into experimental and theoretical. In this connection, it seems important to develop students' practical skills in programming basic mathematical algorithms used in modeling of physical phenomena. Currently, most of the methods studied in this course are materialized in the form of ready-made packages and utilities in program libraries, but a competent specialist needs not only to be able to use them, but also to know the features of the implementation of mathematical algorithms, to represent the areas of their application, understand the degree of reliability of the numerical calculations.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

As a result of mastering the discipline the students shall

Know:

- basic toolbox of computational methods and algorithms;
- scales of processes and the role of various relationships in modeling;

Be able to:

- apply the concepts of scaled and dimensionless variables, evaluate their role in computer modeling;
- independently prepare computer programs for solving specific problems in the field of one’s specialization;

Master:

- mathematical apparatus of numerical integration of mathematical physics equations;
- basics of methodology of computer modeling and organization of modern numerical experiment;
- skills of work with program complexes.

Methods of theoretical physics

CODE:

CREDITS: 6 (1/0/2)

PREREQUISITES: PHY413 "Physics I: Mechanics. Molecular Physics and Thermodynamics", MAT101 "Calculus I", MAT102 " Calculus II"

COURSE GOALS AND OBJECTIVES

- formation in students of modern concept of the fact that both mathematics as a whole and differential and integral equations in particular are a natural language of

physics, which allows to build mathematical models of physical processes in the form of equations and by means of solution and research of these equations, to receive answers to questions of physics;

- formation of general-professional and professional competencies in students in accordance with the requirements to the direction of training "Engineering Physics and Materials Science".

COURSE SUMMARY

First-order differential equations solved with respect to the derivative. Higher order differential equations, n-order equations. Systems of n linear differential equations. Autonomous systems in the plane. Introduction to stability theory. Basic concepts and definitions of calculus of variations. Basic theorem. The concept of strong and weak extrema. The elementary problem in the calculus of variations on the plane; necessary conditions for an extremum; the Lagrange lemma; the Euler equation; the Legendre and Jacobi conditions; the simplified condition for a strong extremum; the Euler Poisson equation. Functional of a vector function; Euler's system of equations. Functional of a function of two variables. Ostrogradskii-Euler equation; Hamilton's principle. Invariance of the Euler equations. The conditional extremum problem; the isoperimetric problem. Functionals with moving endpoints; transversality conditions. Principle of reciprocity. Direct methods of solving variational problems.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

To know the basic principles of the theory of differential equations (existence and singularity theorems of Cauchy problem solution, theorems about continuous dependence of solutions from initial conditions and parameters), theory of linear systems, methods of research of equilibrium states of nonlinear systems of differential equations, fundamental concepts and definitions of calculus of variations as applied to the problems of mechanics.
To be able to use theoretical knowledge in the process of solving specific differential equations and their systems, to build phase portraits of autonomous second-order systems; to formulate problems of calculus of variations; to identify extremes and investigate their nature; to use direct methods of calculus of variations.
To have the skills of solving and investigating differential equations of standard types of first and higher orders, linear equations of arbitrary order and systems of linear equations with constant coefficients, practical methods of solving variational problems of mechanics.

Corrosion and anti-corrosion treatment
CODE -
CREDIT - (2/0/1)
PREREQUISIT – none

DISCIPLINE GOALS AND OBJECTIVES

- introduction to the modern scientific understanding of the causes and types of corrosion of metals and alloys;
- study of the main factors influencing the thermodynamics and kinetics of corrosion processes;
- detailed study of the basic principles and methods of corrosion protection;
- introduction to modern corrosion-resistant, heat-resistant and heat-proof structural materials and protective coatings;
- acquisition of practical skills in choosing corrosion-resistant materials and methods of metal protection against corrosion.

Course objectives: to acquire in-depth knowledge on the basics of the theory of corrosive processes for the choice of structural materials, taking into account anthropogenic and natural factors.

COURSE SUMMARY
The discipline has a practice-oriented approach and is designed to provide students with competence in the study of the causes and types of corrosive damage of metals in various corrosive environments, understanding of the mechanisms of corrosive processes as one of the most important directions of improving the quality of metal products, the choice of scientifically sound methods of protection of metals against corrosion in all environments of natural and industrial activity.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
- to know the basics of the theory of chemical and electrochemical corrosion;
- to be aware of peculiarities of corrosion behavior of structural materials most widely used in mechanical engineering;
- to be aware of the main methods of corrosion protection and types of corrosion-resistant coatings.
- to be able to analyze the corrosive conditions of specific parts and structures and select a corrosion-resistant material and/or method to protect the surface of parts from corrosion;
- to be able to determine the controlling factor of corrosion damage of a part and suggest ways to reduce it.

- fluent knowledge of the terminology within the framework of the course;
- skills of working with reference books, including the Internet;
- mastery of modern computer technologies.

Nonmetallic materials and technologies
CODE -
CREDIT - (1/1/1)
PREREQUISIT – none

DISCIPLINE GOALS AND OBJECTIVESThe goal of the discipline is to gain knowledge about the structure, physical, mechanical, chemical and technological properties of non-metallic materials; modern methods of production and processing technology of non-metallic structural materials by casting, pressure, welding, cutting and other progressive methods of shaping to obtain high quality blanks and machine parts, creation and development of new, cost-effective materials, development and implementation in production of the latest methods of strengthening materials, expanding the range of products, about the role of non-metallic materials in the design of machine parts and mechanisms.
The objectives of the study of the discipline "Nonmetallic materials and technologies" is to master the knowledge of:

regularities linking the chemical composition, structure (structure) and properties of materials;

regularities of the change in the properties of materials in the manufacture and operation of products;

methods of purposeful change of mechanical and decorative properties of materials;

chemical composition and structure, properties and areas of application of the main types of non-metallic materials.

COURSE SUMMARY
The discipline is an integral part of "Materials Science" - the science studying the relationship and patterns of change of properties under the influence of external influences arising during the production and operation of products from these materials. The course "Nonmetallic materials and technologies" is devoted to an in-depth study of synthetic (polymers, plastics) and natural (wood) organic materials, as well as inorganic glass and ceramics.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

Know:

- peculiarities of the structure of organic synthetic (plastics), natural (wood) and inorganic (glass, ceramics) materials;
- basic physical, mechanical and technological properties of these materials;
- laws of changing the properties under the influence of various technological and operational factors;
- ways of improving the specific properties of materials;
- nomenclature, classification, characteristic properties and applications of non-metallic materials used in the production of artistic products;
- fundamental principles of processing technology of different types of non-metallic (organic and inorganic) materials in products;
- main factors determining the rational choice of non-metallic materials for products with enhanced decorative properties.

Be aware of:

- methods of determining the mechanical properties of nonmetallic materials;
- defects in products made of wood, glass, ceramics and ways to prevent them;
- methods of strengthening nonmetallic materials;
- ways to improve the decorative properties of different types of materials studied in the materials discipline;
- influence of external (operational) factors on the properties of non-metallic materials and the durability of products.

Basics of heat treatment and heat strengthening

CODE -

CREDIT - (1/1/1)

PREREQUISIT – none

DISCIPLINE GOALS AND OBJECTIVES

The goal of the discipline is to gain knowledge about the structure, physical, mechanical, chemical and technological properties of materials, the role of heat and chemical-thermal treatment, the classification of types of heat treatment, transformations occurring during heating and cooling, to introduce students to the modern methods and basics of technology of heat treatment of metal structural materials after casting, processing, welding, cutting, surface hardening, thermomechanical processing and other progressive methods of changing the structure and properties of materials in order to obtain high quality blanks and machine parts, creating and developing new, economically alloying steels, materials with special properties.

Obtaining knowledge about the technology and the role of heat treatment of both traditional and new materials and the ability to carry out the correct choice of new progressive technologies and change the properties of materials in the design of machine parts and mechanisms.

COURSE SUMMARY

Learning to develop the best, most economical modes of heat treatment of metals to obtain the desired structure and properties, learning to justify the choice of the most effective of several possible options of heat treatment, trends and prospects of development of heat treatment of metals and alloys, aimed at developing the most effective ways to improve the strength, durability, reliability of metal products and metal saving in the industry.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

Be aware of:

- the main trends and directions of development of modern theoretical and applied materials science and modern technologies of processing and strengthening of materials;
- the mechanisms of the phase and structural transformations, their dependence on the conditions of heat treatment;
- the regularities of formation and management of the structure and properties of materials at mechanical, thermal and other types of impact on the material;

Know:

- regularities reflecting the dependence of mechanical, physical, physical-chemical and technological properties of modern materials on the chemical composition, structural condition and types of treatment;
- technological regimes of thermal, thermomechanical, chemical-thermal and other types of processing of machine-building parts;
- regularities in the relationship between the structure, properties of materials and factors of technological processing;
- specific technological processes most widely used in industry, as well as promising directions for their further development.

Be able to: choose the type and modes of heat and chemical-thermal treatment of industrial alloys, taking into account a given set of technological and operational properties; perform basic operations of heat treatment; control the quality of heat treatment.

Material physics
CODE -
CREDIT - (2/1/0)
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE DISCIPLINE
The purpose of studying this discipline is:

- obtaining knowledge about the structure and properties of metallic and non-metallic materials through mastering the essence of the physical processes underlying phase transformations as a result of various types of processing.

The objectives of the discipline are as follows:

- to study the essence of physical processes occurring in multicomponent and multiphase materials;
- to master physical and chemical methods for analyzing the composition, structure and physical properties of materials from the point of view of evaluating structural parameters

BRIEF DESCRIPTION OF THE COURSE
In materials science, the study of physical properties of materials is based on the method of physical and chemical analysis, which is based on the scientific position that physical properties are uniquely determined by the structure, chemical and phase composition, as well as the technological background of materials. At the same time, for a deeper understanding of the essence of existing laws, as well as for systematization of knowledge on systems with the same characteristics of interatomic interaction, structural and phase state, it is necessary to take into account the features of the electronic structure of a solid.

In this regard, the content of the course "Material physics" includes sections on the atomic-crystalline and electronic structure of materials, crystallization and diffusion mechanisms that determine the processes of structure formation of materials and their physical characteristics.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Must have an idea of the theory of the structure of materials, the structure of pure metals and alloys, phase transformations in a solid.
Must know the physical nature of phase transformations and structural changes in metals, the structure and properties of metallic, composite and non-metallic materials.
Must be able to:

- to analyze graphical constructions of systems illustrating structural and phase changes as a result of the impact of various factors on materials;

- to apply theoretical knowledge when justifying changes in the properties of materials as a result of technological influences;
- to use methods of physical and chemical analysis of the structure and properties of materials in scientific research.

Modern methods of materials research
CODE -
CREDIT- (1/1/1)
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE DISCIPLINE
The purpose of studying this discipline is:

- formation of students' competencies related to understanding the theoretical foundations of the main methods of research of materials used in practice;
- acquisition of skills and abilities in the process of mastering special research methods and processing the results of experiments

The objectives of the discipline are as follows:
- to study of modern methods of materials research and subsequent processing of the results

BRIEF DESCRIPTION OF THE COURSE
Consideration of research methods used in laboratory practice in the study of the structure and composition of the analyzed materials. The presentation of the theoretical foundations of each method, and specific methods of research are described methods. A significant place in the presentation of the material is given to the consideration of the possibilities of their practical application in solving specific problems.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

Must have an idea of modern methods of materials research and analysis of the processing of research results.
Must know:
- theoretical foundations of research, principles of correlation of methodology and research methods;
- object and subject of materials research;

- research methods, techniques and procedures; research programs, knowledge of research sampling procedures, methods of analysis and information processing
- main trends and directions of quantitative and qualitative approaches

Must be able to:
- to highlight the theoretical, applied and tool components of the research;
- to apply basic methods of measurement of information storage, the features that characterize the object of study;
- competently analyze modern problems of materials research;

Practical skills:
- methodology and technology of data collection and analysis methods; principles of system analysis, the ability to build and use models to describe and predict management decisions, to carry out their qualitative and quantitative analysis;
- the main methods of research;
- formation of the sample population, its assessment and types, the ability to calculatethe sampling error, the degree of reliability.

Functional materials

CODE -
CREDIT - (1/0/2)
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE DISCIPLINE

Objective: to show the role of physical phenomena underlying the use of various modern functional materials, as well as their practical implementation in experimental installations and existing technical devices.

During the course, students are introduced to the physical and chemical properties of various modern functional materials and material science aspects of their applied use, as well as to experimental methods for measuring their specific properties.

The purpose of studying the discipline is to prepare students for work in the field of development of high-tech materials with special electrical, magnetic, optical and other properties.

Objectives:

- to teach students the skills of a systematic approach to solving physical and chemical problems of a fundamental and applied nature
- formation of basic ideas about the current state of materials science and the role of materials in various fields of human activity;

- study of the relationship between the use of various fields of science: chemistry, physics and technology to solve materials science problems;
- familiarity with the technical capabilities and features of the main methods of experimental research of functional materials.

BRIEF DESCRIPTION OF THE COURSE
The development of scientific and technological progress makes new demands on modern materials, which include functional materials. Industry is interested not only in metals that are in a stable state and have certain structure, mechanical and physical properties, but also in obtaining new materials with a controlled structure, controlled properties and technical parameters, with a certain dependence of properties on external influences.
The solution of this problem is achieved by studying the influence of the chemical composition and various types of heat treatment, including non-traditional methods of influence on the course of structural and phase transformations and the properties of materials.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
The student should know: basic physical and physico-chemical methods for determining the structure and properties of various materials.
The student should be able to: obtain materials that have the required set of functional properties.
The student must have: skills in preparing for the synthesis of modern materials, conducting the synthesis itself and forming products based on them.

Fundamentals of technological processes of materials production
CODE -
CREDIT - (1/1/1)
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE DISCIPLINE
This discipline is devoted to the study of the structure and properties of materials depending on their composition and processing conditions, as well as the study of the main methods of forming blanks and machine parts. The subject of the discipline is the laws that determine the structure and properties of materials depending on their composition and processing conditions, as well as modern and progressive methods of production and processing of machine-building materials. Objectives of studying the discipline.

The use of various materials in the construction of machines and devices, the need to ensure their reliability in operation, taking into account the features of technological processing methods, as well as the feasibility of manufacturing these structures determine the main tasks of the discipline.

BRIEF DESCRIPTION OF THE COURSE
Regularities of formation of structure materials; structure and properties of materials; heat treatment; thermo-chemical processing; structural in the production and operation of various types of materials; domestic and international notation of structural materials, their compatibility and interchangeability. Requirements for structural materials. The concept of production and properties of basic structural materials; change in the properties of structural materials over time under the influence of operational factors; technology for the restoration of structural materials and their secondary use.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
As a result of studying this discipline, students should know:
- nomenclature, main properties and areas of use, the most common structural engineering materials, as well as methods for their production;
- the essence, content, technological schemes, technological capabilities and areas of application of technological processes for the manufacture of machine parts;
- development trends and recent achievements in mechanical engineering (new highly efficient technological processes, organizational and technical solutions, etc.); be able to:
- to depict schematic diagrams of the most common operations of various technological processes;
- to explain according to these schemes the essence of the process or operation, technological modes of operation, the composition of technological equipment, the main areas of application;
- to develop enlarged technological processes for obtaining blanks and processes for dimensional processing of blanks to obtain the simplest parts with the appointment of the main modes.

Quantum mechanics
CODE - PHY149
CREDIT - (2/0/1)
PREREQUISITE - PHY414

PURPOSE AND OBJECTIVES OF THE COURSE

Assistance to students in achieving their expected learning outcomes in the discipline, which correspond to the planned learning outcomes in the specialty.

BRIEF DESCRIPTION OF THE COURSE
Principles of quantum mechanics. Application of the stationary Schrodinger equation for solving some problems. Movement of microparticles in the field of Central forces. A hydrogen atom. Quantum statistics. Optical quantum generators. Magnetic characteristics. Elementary particles.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Demonstrate the ability to put into practice knowledge and understanding of the basic concepts, principles, theories and facts related to quantum physics, in particular quantum mechanics. Demonstrate the ability to apply the acquired knowledge of quantum mechanics to the formulation, formulation and solution of applied scientific problems in technical physics, using recognized quantum mechanical methods. Demonstrate the ability to conduct a literary review of unsolved problems, independently formulate a scientific problem of a fundamental or applied nature, find methods for solving problems, analyze and present the results obtained in the necessary form and draw conclusions.

Statistical physics and thermodynamics
CODE - PHY163
CREDIT - (2/0/1)
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE COURSE
Give students the basic concepts of statistical physics and thermodynamics where real bodies are considered, which are a system consisting of many particles that interact with each other and with surrounding bodies.

BRIEF DESCRIPTION OF THE COURSE
The course provides a systematic presentation of systematic physics together with thermodynamics. It is based on the Gibbs method. All specific tasks of statistics are considered using General methods. The basic laws of thermodynamics in the form of principles are formulated on the basis of long-term research of real bodies and processes. On the examples of the description of thermodynamic systems in the course, the statistical method is studied, which in itself is a very promising method, which is manifested, in particular, in the description of systems consisting of nanoparticles. Of

particular interest is the consideration of irreversible processes and the method of calculating entropy production as a quantitative measure of irreversibility.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Students have enough basic theoretical training in the field of statistical physics and thermodynamics. The study of thermodynamics helps to understand the mysterious properties of real processes - their irreversibility. When solving problems, be able to pay attention to the accuracy of calculation, which is necessary for the practical application of the acquired knowledge and skills in engineering practice.

Crystal physics
CODE -
CREDIT - 1/1/1
PREREQUISITE - MATH 1

PURPOSES AND OBJECTIVES OF THE COURSE
The aim of the course is to study the theoretical foundations of crystallography and crystal physics using practical exercises. disclosure of the relationship between the structure and properties of crystalline bodies.

BRIEF DESCRIPTION OF THE COURSE
The course examines the structure of condensed media, crystal structure and its description, crystal symmetry, point and space groups, principles of dense and valence packing, elastic properties of crystals, stress and strain tensors, stability of crystal lattices. The teaching of the course is related to the courses "Condensed matter physics", "Mathematical analysis", "Tensor and vector analysis", "Physics of semiconductors and dielectrics", "Group theory" , etc.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
to know the basic concepts of crystallography and crystallophysics, the basics of geometric crystallography, microcrystallography, symmetry theory, crystal optics, crystal chemistry, crystal physics, genetic crystallography, crystal growth and morphology, goniometry, the physical meaning of various coefficients that characterize the properties of crystals; be able to evaluate the value of coefficients that characterize the properties of crystals, and anisotropy, choose the optimal values of the coefficients depending on the specific conditions of practical application of crystals, be able to solve crystallographic problems, build spherical, stereographic, gnomonic, gnomostereographic projections of crystals, correctly describe the external shape and

internal structure of crystals, using the knowledge of point and spatial symmetry necessary for the correct interpretation of the results of independent scientific activity and understanding of special literature.

Condensed matter physics
CODE - PHY196
CREDIT - 1/1/1
PREREQUISITE - PHY196

PURPOSE AND OBJECTIVES OF THE COURSE
Formation of a scientific basis for conscious and purposeful use of the properties of condensed matter. Study of fundamental results of condensed matter physics and methods of practical use of condensed matter properties, practical mastery of methods of theoretical description and basic theoretical models of condensed matter, skills of setting up a physical experiment to study the properties of condensed matter and basic experimental techniques.

BRIEF DESCRIPTION OF THE COURSE
The content of the condensed matter Physics course includes the following sections: types of condensed matter, symmetry and structure of crystals, fundamentals of band theory of conductivity, lattice dynamics, phonons, strongly doped semiconductors, non-crystalline solids, surface and contact phenomena, dielectric properties of materials, magnetic properties of solids, superconductivity.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
As a result of studying the discipline, the student must know the theoretical foundations of condensed matter physics; be able to understand, present and critically analyze basic general physical information; use the theoretical foundations, basic concepts, laws and models of physics; possess methods for processing and analyzing experimental and theoretical information.

MECHANICS OF MATERIALS
CODE -
CREDIT - 3 (1/0/2)
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE DISCIPLINE

The main purpose of studying the discipline is to form future bachelors' basic and most important ideas about modern methods of training a broad-profile specialist who can technically competently operate aircraft and aircraft engines, perform engineering calculations and design

The main objectives of the discipline are:

1. To provide students with a set of theoretical knowledge on the basics of design, basic provisions of calculations and design of mechanisms, assembly units (units) and general-purpose parts of mechanical systems.
2. Possession of modern methods, skills and abilities for the production of engineering calculations and design.
3. To prepare students for the development of samples of equipment and devices studied in other disciplines, as well as the implementation of course projects, final qualifying works.

BRIEF DESCRIPTION OF THE COURSE

Mechanics is a fundamental discipline, on the basis of which such important disciplines for General engineering education as "Resistance of materials", "Theory of mechanisms and machines", "Machine parts", as well as a large number of special engineering disciplines devoted to the calculation of the strength of materials, apparatuses, buildings, etc. are based. Study of mechanics gives the minimum fundamental knowledge, which future specialist will be able to master all the new, than he will face in the course of further scientific and technical progress. Finally, the study of this course contributes to the expansion of scientific and engineering horizons, as well as to the improvement of the general culture of the future specialist, the development of his thinking.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

The student should have an idea of: the basics of calculations for the strength and rigidity of structural parts, the principles of selection and design of standard parts and equipment, methods of calculation for the stability and endurance of structural elements, methods of calculation of structural elements under dynamic loading. Principles of selection of materials for structural elements and equipment.

As a result of studying the discipline, the student must:

- know the basic concepts and laws of mechanics and the methods of studying equilibrium that follow from these laws; the movement of a material point, a solid

body and a mechanical system (in the scope of this program), understand the methods of mechanics that are considered in this course;
know the strength conditions and stiffness conditions for the simplest types of loading;
strength conditions for complex resistance of structural elements;
conditions of strength and stiffness under dynamic loading.

- be able to apply the acquired knowledge to solving the relevant problems of mechanics;
- be able to create design schemes to determine the internal stress and strain;
- rightly to choose construction materials;
- use methods for calculating the strength and stiffness of structural elements.

Physics of semiconductor devices
CODE - PHY161
CREDIT - 6(1/1/1)
PREREQUISITE - no

THE PURPOSE AND OBJECTIVES OF THE COURSE are to train competent specialists who have an understanding of the physical principles underlying the operation of semiconductor devices and their scope of application; to master methods for solving problems of measuring and calculating various semiconductor devices.

BRIEF DESCRIPTION OF THE COURSE-Semiconductor devices based on homogeneous semiconductors (thermal resistances, photo resistances, varistors, thermoelements). Potential barriers in semiconductor devices. Metal-semiconductor contact. Potential barrier in the p-n transition. The structure of the metal - insulator - semiconductor. Semiconductor diodes. Microwave diodes, semiconductor stabilitrons, varicaps, photodiodes and photocells. Impact avalanche transit - time diodes, Gunn diodes. The heterojunctions. Development of ideas about heterojunctions. Anisotype and isohypse heterojunctions. Bipolar transistors. The planar transistor. Parameter systems, frequency properties. Drift transistor. Constructive ways to create microwave and high-power bipolar transistors. Field-effect transistors with p-n junction, basic parameters and characteristics. Isolated gate field effect transistors. Properties of the metal-dielectric-semiconductor structure. Energy diagram, static characteristics

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Mastering the course of physics of semiconductor devices involves the formation of students: a clear understanding of the principles of operation of the most important

semiconductor devices; their design and manufacturing technology; ways to improve parameters through the use of new materials; skills in measuring and analyzing the most important characteristics of diodes and transistors; simple calculations of device parameters; selection of material and design to achieve the necessary parameters.

Physics of matter (Introduction to the specialty).
CODE - (not available)
CREDIT - 6 (1/1/1)
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the course **"Physics of matter (Introduction to the specialty)"** is a systematic presentation of the regularities of changes in the structure, structure and properties of matter depending on its aggregate state and external conditions; expanding knowledge about the structure of matter.
BRIEF DESCRIPTION OF THE COURSE
The discipline **"Physics of matter (Introduction to the specialty)"** examines the fundamental aspects of the physical and chemical behavior of gaseous, liquid and solid substances, forms the basic concepts and ideas of condensed matter physics for the application of this knowledge in various fields of science and technology.
KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
must know: the main types of condensed matter, the symmetric classification of crystal lattices, the main types of structural defects, elements of the theory of elasticity, the main processes occurring in crystals.
must be able to: determine the structure of the simplest lattices, work with laboratory equipment and modern scientific equipment.
have the skills to: conduct a physical experiment.

Alternative technologies
CODE - (not available)
CREDIT - 6(1/1/1)
PREREQUISITE - Physics 1,2.

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of studying the discipline "Alternative technologies" is to provide knowledge about alternative energy production technologies, methods and means of modern information technologies for analyzing the energy efficiency of various methods of generating electric energy. **Objectives** of the discipline: the Study of the main renewable energy resources, the study of the basic principles of use, designs and operating modes of the corresponding power plants, the study of the world and domestic experience of their operation, the prospects for the development of energy on non-traditional and renewable energy sources.
BRIEF DESCRIPTION OF THE COURSE
The discipline "Alternative technologies" forms students ' knowledge in the field of development prospects and the existing world and domestic experience in the development of alternative energy sources in relation to traditional ones.
KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
After studying the discipline, the student must:
know: methods of theoretical experimental research of alternative sources; basic classifications of alternative sources; basic laws for calculating the parameters of alternative installations.
be able to: use the principles of classification of alternative sources; use the basic laws used to calculate the parameters of alternative installations.
possess: classification of alternative sources; basic laws and the ability to apply them to calculate alternative sources.

Defense of the thesis / thesis project
CODE -
CREDIT - 4
PREREQUISITE - no

PURPOSE AND OBJECTIVES OF THE COURSE

This course is intended for the systematization and implementation of the thesis. The purpose of the thesis (project) is:

1) systematization, consolidation and expansion of theoretical knowledge and practical skills and their application in solving specific scientific, technical, economic and production tasks, and task cultural purposes; 2) the development of skills of independent work and mastery of methods of scientific research and experimentation in solving emerging problems and issues; 3) clarification of readiness of the student for independent work in the conditions of modern production, science, technology, culture, and level of professional competence.

BRIEF DESCRIPTION OF THE COURSE

This course is designed to reveal the necessary basic concepts, understanding the current problems of the scientific field in which the thesis is being performed. A thesis (project) is a written final work that is performed at the final stage of training, if this is provided for by the state mandatory standard of education and the curriculum of the specialty.
The thesis (project) is a generalization of the results of independent study and research of the actual problem of a specific specialty of the corresponding branch of science.
The thesis (project) is carried out under the supervision of the supervisor and meet one of the following requirements:
1) summarize the results of research, design decisions carried out by scientists, analysts, practitioners: engineers, designers, managers, economists; 2) contain scientifically based theoretical conclusions on the object under study; 3) contain scientifically based results, the use of which provides a solution to a specific problem.
Students who have successfully completed a theoretical bachelor's degree course in the amount of at least 240 credits are allowed to participate in the thesis (project).

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

Upon completion of the course, the student develops basic knowledge in the scientific field of the field of study, skills in applying the studied methods of research of materials, methods of analysis and processing of experimental and literary information, as well as the ability to systematize and present data.

The contents