

**Institute of Industrial Automation and Digitalization
named after A. Burkitbaev**

Department of "Electronics, telecommunications and space technology"

CURRICULUM PROGRAM

6B07112, 6B07104

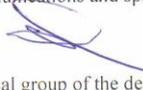
«ELECTRONIC and ELECTRICAL ENGINEERING»

**Bachelor of Engineering and Technology in Electronics and Electrical
Engineering in 6B071 - Engineering and Engineering**

Group of Educational programs B062 "Electrical Engineering and Energy" и
B063 "Electrical Engineering and Automation"

Almaty 2020

The program was drawn up and signed by the parties:
from Satbayev University:

1. Director of the A. Burkitbaev Institute of Industrial Automation and Digitalization
 B.O. Omarbekov
 2. Head of the department "Electronics, telecommunications and space technology"
 I. Syrgabaev
 3. Chairman of the educational and methodological group of the department,
candidate of technical sciences
 E. Tashtay
- From employers
 T.M. Ergaliyeva
Commercial Director of «Egida GROUP»

Approved at the meeting of Educational and Methodological Board of Satpayev University. (Minutes # 4, 14.01.2020)

Qualification:

Level 6 of the National Qualifications Framework:
6B071 - Engineering and Engineering (bachelor)
B062 "Electrical Engineering and Energy" и B063 "Electrical Engineering and Automation"

Professional competence: providing deep theoretical knowledge and practical skills in the field of electronics and electrical engineering

Разработано	Рассмотрено заседание УС Института	Утверждено УМС КазННТУ	Страница 2 из 53
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1 Brief program description

Professional activity of graduates of the program is directed to the area of industrial and civil electrical equipment and electronics, basic elements the Internet of things and clever to technology.

Training of specialists on electronics and electrical equipment will be carried out according to the new educational program (EP) of "Electronic and Electrical Engineering" - "Electronics and Electrical equipment" in which there are two specializations: "Electronic systems" and "Electrotechnical devices".

Content of disciplines of the educational program was developed taking into account the appropriate educational programs of leading universities of the world and the international qualifier of professional activity for the direction of the electronic engineer and electrician.

Types of professional activity are: production and technological; service and operational; organizational and administrative; assembly and adjustment; settlement and design; experimental and research.

Objects of professional activity are the systems including: development, design of element base of electronics and electrical equipment, including intellectual systems for branches of digital economy by means of programmable logic integrated circuits, sensors and converters.

The purpose of the educational program (EP) – training of highly qualified specialists in the field of the digital electronics and electrical equipment having the profound knowledge, abilities and practical skills providing high-quality performance of the functional obligations for the chosen specialty, mobility in the market of professional work knowing the last world achievements and the prospects of development of the electronic industry.

Task of the new educational program is:

- training of new competitive generation of technical specialists in the field of electronics and electrotechnical devices for labor market, initiative, able to work in team, having high personal and professional competences;
- integration of educational and scientific activity;
- establishment of partnership with the leading higher education institutions of the FSU and beyond for the purpose of improvement of quality of education, for support of technical and cultural ties;
- extension of contacts with customers of educational services, employers for the purpose of definition of requirements to quality of training of experts, to carrying out courses, seminars, master classes, training, work practice.

The contents of the educational program (EP) of "Electronic and Electrical Engineering" will be implemented according to credit technology of training and to be carried out in the state, Russian and English languages.

OP allows to realize the principles of Bologna Process successfully. On the basis

of the choice and independent planning by students of the sequence of studying of disciplines, they independently form the individual curriculum (IC) on each semester with the help

edvayzer on the basis of the educational program and the catalog of elective disciplines.

In the educational program the volume of mathematical, natural-science, basic and language disciplines is increased.

Such disciplines as are studied: "Physical bases of electronics", "Theories of signaling", "Circuitry of electronic means", "Microprocessor and microcontroller devices and systems", "Theoretical bases of electrical equipment", "Bases of programming of S/s", "Electrotechnical materials", "Bases of power electronics", "Superhigh-frequency electronics", "Technical means of automation and management", "Electronic sensors and converters", "Optoelectronics", "Programmable logic integrated circuits", "Electronic devices of wireless communication", "Mechatronics", "Artificial intelligence", "Design of electronic means", etc.

Besides attention is paid to current trends in development of electronics and electrical equipment in the field of artificial intelligence, reliability of electrotechnical and electronic devices.

Students will do practical training in such companies as JSC Saimang, JSC Transtelecom, JSC ALTEL, JSC KazTransCom, Kar-Tel LLP, ASKB "Ala Tau", branches of the company LG, Cisco, Rochde&Schwarz, IKTT LLP, Kazakhstan ASELSAN engineering LLP, etc. and also on the basic service centers large international the companies on electronic industry.

According to the program of the academic mobility the best students will be trained at the leading foreign universities on the corresponding OP.

Graduates in the Electronic and Electrical Engineering direction will work as specialists in electronics, operators, managers on the organization of business processes of intellectual systems and developers of systems a smart of things for various sectors of the economy.

2 Entry Requirements

Reception of the persons arriving on the educational program "Telecommunication" is carried out according to statements of the entrant who completed in full an average, a secondary special education on a competitive basis according to points of the certificate issued by results of uniform national testing at the minimum assessment not less than 65 points.

Special requirements to revenues to the program are applied to graduates of 12 summer schools, colleges, programs of an applied bachelor degree, NICHES, etc. Such entrants should pass diagnostic test on English, mathematics, physics and special disciplines.

Rules of reoffset of the credits for the accelerated (reduced) training at base of 12-year secondary, secondary technical and higher education

Code	Type of competence	Competency description	Result of competence	Responsible
GENERAL				
(Implies full studying with possible additional depending on the level of knowledge)				
G1	Communication skills	Fluent oral, written and communication skills in several languages ability to communicate using a second language ability to be communicative in different situations possess the basics of academic writing in their native language language level diagnostic test	Full 4-year education with achievement of at least 240 academic credits (of which 120 are contact classroom academic credits) with the possible transfer of credits in a second language where the student has an advanced level. The language level is determined by taking a diagnostic test.	Department of Kazakh and Russian, Department of English
G2	Math literacy	Basic mathematical thinking at the communication level the ability to solve situational problems based on the mathematical apparatus of algebra and principals of mathematical analysis diagnostic test for mathematical literacy in algebra	Full 4-year study with achievement of at least 240 academic credits (of which 120 are contact classroom academic credits). If the diagnostic test is passed positively, the level is Mathematics 1, if it is negative, the level is Algebra and basic analysis	Department of Math
G3	Basic Literacy in Natural Sciences	Basic understanding of the scientific picture of the world with an understanding of the essence of the basic laws of science understanding of basic hypotheses, laws, methods, formulation of conclusions and assessment of errors	Full 4-year training with achievement of at least 240 academic credits (including 120 contact classroom academic credits). If the diagnostic test is passed positively, the level is Physics 1, General Chemistry, if it is negative – the level is Principles of Physics and the Basic Foundations of Chemistry	Departments in the areas of natural sciences
SPECIFIC				
(implies reduced studying due to credit transfer, depending on the level of knowledge in competencies for graduates of 12-year schools, colleges, universities, including humanitarian and economic areas)				
S1	Communication skills	Fluent bilingual oral, written and communicative skills ability to communicate fluently with a third language different style and genre writing skills skills of deep understanding and interpretation of own work of a	Full credit transfer by language (Kazakh and Russian)	Department of Kazakh and Russian

		certain level of complexity (essay) basic aesthetic and theoretical literacy as a condition for full perception, interpretation of the original text		
S2	Math literacy	Special mathematical thinking using induction and deduction, generalization and concretization, analysis and synthesis, classification and systematization, abstraction and analogy ability to formulate, substantiate and prove provisions application of general mathematical concepts, formulas and extended spatial perception for mathematical problems complete understanding of the basics of mathematical analysis	Transfer of credits in Mathematics (Calculus) I	Department of Math
S3	Special literacy in the natural sciences (Physics, Chemistry, Biology and Geography)	A broad scientific perception of the world, a fundamental understanding of natural phenomena critical perception for understanding the phenomena of the world cognitive abilities to formulate a scientific understanding of the forms of existence of matter, its interaction in nature	Transfer of credits in Physics I, General Chemistry, General Biology, Introduction to Geology, Introduction to Geodesy; Educational practice, etc.	Departments in the areas of natural sciences
S4	English	Readiness for further self-study in English in various fields readiness to gain experience in project and research work using the English language	Transfer of credits in English language above academic to professional level (up to 15 credits)	Department of English
S5	Computer skills	Basic programming skills in one modern language use of software and applications for teaching various disciplines	Transfer of credits in Introduction to information and communication technologies, Information and communication technologies	Department of Software Engineering
S6	Socio-humanitarian competences and behavior	- Understanding and awareness of the responsibility of every citizen for the development of the country and the world - the ability to discuss ethical and moral aspects in society, culture and science	Transfer of credits in modern history of Kazakhstan (except for the state exam)	Department of Social Studies
		critical understanding and ability to debate on modern scientific hypotheses and theories	Transfer of credits in philosophy and other humanitarian disciplines	

PROFESSIONAL				
(implies reduced studying due to credit transfer depending on the level of knowledge in competencies for college graduates, AV schools, universities)				
P1	Professional competencies	<ul style="list-style-type: none"> - Critical perception and deep understanding of professional competencies at level 5 or 6 - ability to discuss and argue on professional issues within the framework of the mastered program 	Transfer of credits in basic professional disciplines, including Introduction to the specialty, Engineering ethics, Technology of robotic production, Technological objects of automation, Theoretical foundations of electrical engineering, Technological measurements and devices, Mathematical foundations of control theory, Automation electronic devices.	Graduation Department
P2	General engineering competence	<ul style="list-style-type: none"> - Basic general engineering skills and knowledge, ability to solve general engineering tasks and problems - be able to use application packages for processing experimental data, solving systems of algebraic and differential equations 	Transfer of credits in general engineering disciplines (Engineering Graphics, Descriptive Geometry, Basic Electrical Engineering, Basic Microelectronics)	Graduation Department
P3	Computer engineering competence	<ul style="list-style-type: none"> - basic skills of using computer programs and software systems for solving general engineering tasks 	Transfer of credits in Computer graphics, Computer modeling and programming in MatLab	Graduation Department
P4	Socio-economic competence	<ul style="list-style-type: none"> - critical understanding and cognitive abilities to argue on contemporary social and economic issues - a basic understanding of the economic evaluation of objects of study and profitability of projects 	Transfer of credits in social and humanitarian and technical and economic disciplines to offset the electives	Graduation Department

The university may refuse to transfer credits if a low diagnostic level is confirmed or in the completed disciplines the final grades were lower than A and B.

3 Requirements to complete the course and receive a diploma

Mandatory standard requirements for graduation and assignment of an academic degree of bachelor: mastering at least 240 academic credits of theoretical studies, performing the final thesis or passing the state exam in the specialty.

Special requirements for graduation in this program.
graduate should know:

- English (technical);
 - principles of building electronic circuits and their functioning,
 - principles of construction and operation of radio engineering, electronics and telecommunications systems,
 - features of network and telecommunication technologies,
 - norms and standards of project documentation applied in the industry,
 - modern world trends in the field of telecommunication technologies.
- graduate must be able to:
- develop, implement, test and exploit information and telecommunication systems for various purposes;
 - to design telecommunication systems and their elements in various fields;
 - apply modern communication technologies for processing and transmitting large amounts of information, analyze it for decision making;
 - have skills in teamwork within developers and users of telecommunications engineering systems.

4 Curriculum of the educational program

Year of study	Code	Name of discipline	Cycle	OThe total amount of credits	lec/lab/pr/IWS	code of transfer credit	Prerequisites	Co de	Name of discipline	Cycle	OThe total amount of credits	lec/lab/pr/IWS	code of transfer credit	Prerequisites	
1	1st semeste							2nd semester							
	LNG 1051	Beginner (A1)	G	6	0/0/3/3	S4	Diagno stic test	LNG 1052	Elementary English (A1)	G	6	0/0/3/3	S4	LNG 1051	
	LNG 1052	Elementary English (A1)						LNG 1053	General English 1 (A2)					LNG 1052	
	LNG 1053	General English 1 (A2)						LNG 1054	General English 2 (A2)					LNG 1053	
	LNG 1054	General English 2 (A2)						LNG 1055	Academic English (B1)					LNG 1054	
	LNG 1055	Academic English (B1)						LNG 1056	Business English (B2)					LNG 1055	
	LNG 1056	Business English (B2)						LNG 1057	Professional English (B2+)					LNG1056	
	LNG 1012	Kazakh (Russian) (A2)	G	4	0/0/2/2	S1	Diagno stic test	LNG 1102 .1	Academic Kazakh (Russian) (B1)	G	6	0/0/3/3	S1	LNG 10121	
	LNG 1012.1	Academic Kazakh (Russian) (B1)						LNG 1102 .2	Business Kazakh (Russian) (B2)					LNG 1012.1	
	LNG 1012.2	Business Kazakh (Russian) (B2)						1105	Electives					LNG 1012.2	
	KFK 101	Physical training	G	4	0/0/2/2		no	KFK 102	Physical training	G	4	0/0/2/2		AAP 106	
	HUM 100	Contemporary history of Kazakhstan	G	6	1/0/2/3	S6	no	ELC 197	Introduction to Electronic Science and Engineering	B	6	2/0/1/3	P1	no	
	MAT 00110	Algebra and introduction to calculus	B	6	1/0/2/3	S2	Diagno stic test	MA T101	Mathematics I	B	6	1/0/2/3	no	MAT 100	
	MAT 101	Mathematics I						MA T102	Mathematics II					MAT 101	
	PHY 400	Introduction to Physics	B	6	1/1/1/3	S3	Diagno stic test	GEN 101	Engineering and Computer Graphics	B	6	1/0/2/3	P2	no	
	PHY 111	Physics I						PHY 111	Physics I					PHY 400	
	ELC 198	Theory of inventive problem solving	B	6	2/0/1/3		no	PHY 112	Physics II	B	6	1/1/1/3	no	PHY 111	
	Total:				38	38			Total:				40	40	
	2	3th semester							4th semester						
		LNG 1053	General English 1 (A2)	G	6	0/0/3/3	no		LNG 1052	LNG 1054	General English 2 (A2)	G	6	0/0/3/3	no
LNG 1054		General English 2 (A2)	LNG 1053						LNG 1055	Academic English (B1)	LNG 1054				
LNG 1055		Academic English (B1)	LNG 1054						LNG 1056	Business English (B2)	LNG 1055				
LNG 1056		Business English (B2)	LNG 1055						LNG 1057	Professional English (B2+)	LNG 1056				

LNG 1057	Professional English (B2+)					LNG 1056	2108	Electives					LNG 1056
HUM 126	Social & Political Knowledge	G	8	4/0/0/4	S6	no	HU M12 4	Philosophy	G	6	1/0/2/3	S6	no
CSE 174	Information and communication technology	G	6	2/0/1/3	S5	no	ELC 166	Theoretical Foundations of Electrical Engineering II	B	6	2/1/0/3	P1-2	ELC 165
MAT 102	Mathematics II	B	6	1/0/2/3	no	MAT 101	MA T103	Mathematics III	B	6	1/0/2/3	no	MAT 102
MAT 103	Mathematics III					MAT 102	MA T126	Ordinary differential equations. Matlab					MAT 103
ELC 165	Theoretical Foundations of Electrical Engineering I	B	6	2/1/0/3	P1-2	PHY 111	ELC 401	Signal Transmission Theory	B	6	1/1/1/3	no	CSE 174
PHY 112	Physics II	B	6	1/1/1/3	no	PHY 111	ELC 196	Physical fundamentals of electronics	B	6	1/1/1/3	P1-3	ELC 165
2209	Electives												
Total:			38	38				Total:		36	36		
5th semester						6th semester							
MAT 126	Ordinary differential equations. Matlab	B	6	1/0/2/3	no	MAT 103	MA T127	Partial differential equations. Matlab	B	6	1/0/2/3	no	MAT 126
MAT 127	Partial differential equations. Matlab					MAT1 26	3219	Electives					
AUT 146	Fundamentals of Automation	B	6	2/1/0/3	P1-3	PHY 111	ELC 188	Fundamentals of power electronics	B	6	1/1/1/3	no	ELC 402
ELC 420	Optics in telecommunications	B	6	2/0/1/3	no	ELC 401	ELC 104	Secondary sources of power supply					
ELC 402	Circuitry of electronic means	S	6	1/1/1/3	no	ELC 196	ELC 403	Microprocessor and microcontroller devices and systems	S	6	1/1/1/3	no	ELC 402
ELC 406	Electrotechnical materials	S	6	2/0/1/3	no	ELC 166	KTT 107	Microprocessors and microprocessor systems					2/1/0/3
							ELC 407	Optoelectronics	S	6	1/0/2/3	no	ELC 402
							AUT 111	Linear system of automatic control	S	6	1/1/1/3	no	AUT 146
Total:			30	30				Total:		30	30		
7th semester						8th semester							
ELC 410	Programmable logic integrated circuits	S	6	2/0/1/3	no	ELC 403	KTT 146	Intellectual networks	S	6	2/0/1/3	no	ELC 412
ELC 409	Electronic sensors and transducers	S	6	2/1/0/3	no	ELC 407	ELC 414	Seminar of electronic engineering	S	6	2/1/0/3	no	ELC 412

ELC 412	Design of electronic means	S	6	2/1/0/3	no	ELC 407	ELC 415	Project management in the electrical industry	S	6	2/0/1/3	no	no
ELC 143	Development of radio electronic devices			1/1/1/3			ECA 001	Preparation and writing of the graduate work (project)	FA	4			
ELC 421	Long Range Sensing Methods	S	6	2/0/1/3	no	ELC 407	ECA 103	Protection of the graduate work (project)	FA	6			
ELC 146	Systems of satellite navigation and sounding												
ECA 001	Preparation and writing of the graduate work (project)	FA	4										
Total:			28	24			Total:			28	18		

Additional academic programes (AAP)					Total number of credits			
Year of study	Code	Name of discipline	Credits	Semester	Cycle of disciplines	Credits		
						compulsary	elective	total
2	AAP122,132	Physical education III, IV	0	3-4	Cycle of general disciplines (G)	56	12	68
1	AAP101	Internship	2	2	Cycle of basic disciplines (B)	96	18	114
2	AAP109	Industrial internship I	2	4	Cycle of special disciplines (S)	54	18	72
3	AAP103	Industrial internship II	4	6	Total of theoretical study :	206	24	254
2-3	AAP500	Military training		3-6	Final attestation (FA)	8	0	8
					Additional education	14	0	14
					Total	22	0	22
					Auditorium volume of credits of theoretical training	115	12	127

5 Descriptors of the level and volume of knowledge, skills, abilities and competencies (to describe)

A - knowledge and understanding of:

A1 - the scientific principles underlying the study of general professional and special disciplines, containing both basic and in-depth courses for fundamental training in the field of radio engineering, electronics and telecommunications;

A2 - principles of operation and technical characteristics of radio-electronic equipment, switching and communication facilities, signaling protocols; measurement techniques in communications and electronics;

A3 - collaborative analysis methodologies; design and decision making in difficult social and professional situations; ways of communicating and reconciling points of view; formatting and presentation of analytical and project documentation.

B - application of knowledge and understanding:

B1 - self-development and proposal of various options for solving professional problems using theoretical and practical knowledge;

B2 - for the design of radio engineering systems, electronics and telecommunications networks, taking into account real constraints (environmental and social impact, manufacturability and sustainable development);

B3 - for the organization of work on the collection, storage and processing of information used in the field of professional activity.

C - the formation of judgments:

C1 - on modern information transfer systems, new technologies in radio engineering, electronics and telecommunications;

C2 - about modern approaches in telecommunication technologies for creating multi-service and intelligent networks, at the same time being able to compare, formulate conclusions, build their own arguments, express and justify their position;

C3 - about modern technical support equipment for radio engineering and telecommunication systems, which allow creating optimal variants of communication networks and corresponding electronic equipment.

D - personal abilities:

D1 - awareness of the social importance of the profession, adherence to the principles of professional ethics, improvement of professional and personal qualities of a specialist in the field of radio engineering, electronics and telecommunications;

D2 - the desire to develop intellectual, moral, communication, organizational and managerial skills;

D3 - the ability to listen, persuade and argue, the ability to find a compromise, to relate their opinion with the opinion of the team.

6 Competences after completion of curriculum

B - Basic knowledge and skills

B1- be able to analyze current problems of the modern history of Kazakhstan;

B2 - to know and put into practice the basics of professional ethics in engineering;

B3 - to know modern and perspective directions of development of telecommunication and information networks and systems, radar and radio navigation systems, computer technologies, modern software.

P - Professional competencies, including according to the requirements of industry professional standards:

P1 - a wide range of theoretical and practical knowledge in the professional field;

P2 - the ability to design and install communication equipment; work with various communication networks; set up telecommunications equipment;

P3 - to provide technical support to users.

O - Universal, social and ethical competences:

O1 - the ability to learn continuously, to concentrate; be confident in the face of uncertainty; have a high level of spatial and logical thinking;

O2 - to be able to work in a team, have organizational skills, set priorities, quickly master new knowledge and skills, put them into practice;

O3 - to be result-oriented, to plan and organize self-development effectively;

O4 - is able to freely use English as a means of business communication, a source of new knowledge

C - Special and managerial competencies

C1 - independent management and control of the processes of labor and educational activities within the framework of the strategy, policies and goals of the organization, discussion of the problem, argumentation of the findings and competent handling of information;

C2 - the ability to motivate to solve certain tasks, the ability to be responsible: for the result of the work at the level of the unit or enterprise

C3 - the ability to demonstrate a set of skills to manage the process of work, the ability to choose methods, methodologies and evaluation criteria for obtaining results, distribute and delegate authority, form teams, and make decisions on the course of the production process.

7 Policy for obtaining Minor degree

When mastering at least 12 credits in the disciplines of the program, including the following mandatory disciplines:

M1- English language;

M2- Kazakh (Russian) language

M3 - Modern history of Kazakhstan;

M4 - Physics 1 and 2;

M5 - Mathematics 1,2,3;

M6- Theory of electrical circuits;

M7 - Fundamentals of radio engineering and telecommunications (introduction to the specialty);

M8 - Fundamentals of electronic and measuring equipment;

M9 - Theory of electrical communication

An additional Minor degree is assigned with the issuance of a supplement to the state diploma.

8 ECTS Diploma Supplement

ECTS - European Credit Transfer and Accumulation System is a pan-European system of accounting for students' academic work during the study of an educational program or course. In practice, the ECTS system is used when students move from one educational institution to another throughout the European Union and others who have adopted this system, including the Republic of Kazakhstan. One academic year corresponds to 60 ECTS credits (36 credits to the Republic of Kazakhstan), which is about 1,500–1,800 training hours.

To get a bachelor's degree, you need to earn from 215 ECTS credits (129 credits of the Republic of Kazakhstan), and for the master's degree you need to get the missing up to 290 (that is, another 75 ECTS credits or 50 credits of the RK).

Supplement consists of 8 mandatory points in English / Kazakh / Russian. It is a standardized text that confirms compliance with the developed application to European standards. The form of the European Diploma Supplement is given in Appendix A.

Section 1 Information about the holder of the qualification: the last name, first name (as recorded in the passport), date and place of birth, identification number or student code.

Section 2 Information about the qualification obtained: the name of the qualification, Major specialty, additional Minor specialty (if any), the name and status of the higher education institution conferring the qualification in the native language, the name and status of the higher education institution awarding the qualification in English, language of study and examination.

Section 3 Information on the level of qualification: indicates the level of qualification - undergraduate (graduate, doctoral), the duration of study, entry requirements.

Section 4 Information about the content of study and the results obtained: indicate the form of training - full, distance, reduced full, the program requirement (the required amount for the program), the content of the educational program (compulsory and elective disciplines, coursework completed by the student, past practice, a diploma work with an indication of the complexity of disciplines, practices, term papers and dissertations, status (mandatory, optional, additional), final grades) in the RK and ECTS credits, national rating scale approved by the MONRK and its description, the mechanism for transferring grades to the European system, the general classification of qualifications.

Section 5 Professional qualification characteristics: does the qualification give an opportunity to move to the next level of education and what requirements for this must be fulfilled, professional status (what professional rights do students acquire with qualification).

Section 6 Additional information: additional information about the university, additional sources of information.

Section 7 Supplement certification: indicate the date of qualification, date of issuance, name, name of the official certifying the diploma supplement, signing the diploma itself; All this information is stamped.

Section 8 Information on the national system of higher education.

This supplement is issued only at the end of the university upon the application of a graduate on a reimbursable basis according to the norms established by the university.

To obtain the supplement, you must submit a written (electronic) application to the office of the university with a copy of the payment receipt.

The supplement is issued by the Office of the Registrar within 15 working days from the date of application and is registered in the journal of issuance and registration of diplomas and applications. Application forms are stored in the Office Registrar. An electronic record of the issuance of this Diploma Supplement is generated in the graduate's personal portfolio on the university portal.

Description of disciplines

Introduction to Electronic Science and Engineering

THE CODE – ELC 197

THE CREDIT – 3 (2/0/1/3)

There is no PREREKVIZIT – no

PURPOSE AND PROBLEMS OF THE COURSE

Training of students in methods and fundamentals of electronic science and electronic engineering. Besides, students need to be informed of the main concepts, models and the principles of creation of the electronic industry of the developed states, modern problems of the republic of development of digital economy, trends of their development. Requirements of the international standards in construction clever technologies to electronic element base.

SHORT DESCRIPTION OF THE COURSE

Idea of trends of development of technologies of the electronic industry, of the regularities of their development defining communication between indicators of quality of element base, speed parameters, indicators of energy consumption of electronic systems. The general principles of creation of element base электроннй engineering, a basis of development of science in the elektironny and electrotechnical industries.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of discipline the student has to:

- to have an idea of trends of development of technologies of electronic industry, of the regularities of their development defining communication between indicators of quality of element base, power parameters, economic indicators of development of digital systems;
- to know the general principles of creation of electronic engineering, radio engineering; requirements of the international standards to development and design of element base;
- to be able to analyze structure of construction and characteristics (indicators) of electronic devices and the systems of analog and digital information processing; to apply methods of the analysis and synthesis, the technical solutions used in electronic devices and electrotechnical systems.

Algebra and introduction to mathematical analysis

THE CODE IS MAT100

THE CREDIT – 3 (1/0/2/3)

PREREKVIZIT – diagnostic test

PURPOSE AND PROBLEMS OF THE COURSE

The purpose of a course to acquaint students with the main ideas and concepts of algebra and the mathematical analysis and formation of the basic knowledge necessary for studying of the course "Mathematics 1".

Problems of a course – formation of skills for studying of mathematical disciplines and effective use of mathematical methods for the solution of research and practical tasks in professional area.

SHORT DESCRIPTION OF THE COURSE

"The algebra and introduction to the analysis" are aware the basic concepts of algebra, the mathematical analysis, differential and integrated calculations are given.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

Student

has to know:

- basic concepts of algebra;
- basic concepts of the mathematical analysis;
- main elementary functions;

has to be able:

- to find solutions of the equations and inequalities, the systems of the equations and inequalities;
- to transform algebraic and trigonometrical expressions;
- to solve text problems;
- to find a derivative of elementary functions;
- to investigate functions by means of a derivative;
- to find uncertain integral from elementary functions;
- to find a certain integral;
- to find the area of a curvilinear trapezoid.

Mathematics I

CODE – MAT00121

CREDIT – 3 (1/0/2/3)

PREREQUISITE – Elementary School Mathematics / Diagnostic Test

GOAL AND OBJECTIVES OF THE COURSE

The main goal of the course is to provide the future specialist with a certain amount of knowledge in the sections of the “Mathematics I” course, which is necessary for studying related engineering disciplines. Introduce students to ideas and concepts of mathematical analysis. To focus on the formation of basic knowledge and skills with a high degree of their understanding of differential and integral calculus.

Course objectives:

obtain knowledge necessary for the effective use of rapidly developing mathematical methods; obtain the skill of building and researching mathematical models; possession of the fundamental sections of mathematics necessary for solving research and practical problems in the professional field.

BRIEF DESCRIPTION OF THE COURSE

In the course “Mathematics I”, the following sections are presented: introduction to analysis, differential and integral calculus

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

The study of this discipline will allow the student to apply the “Mathematics-I” course to solving simple practical problems, to find tools sufficient for their research, and to obtain numerical results in some standard situations.

Mathematics II

CODE – MAT00122

CREDIT – 3 (1/0/2/3)

PREREQUISITE – Mathematics I

GOAL AND OBJECTIVES OF THE COURSE

The purpose of teaching the course “Mathematics II” is to form the bachelor's ideas about modern mathematics as a whole as a coherent system of theoretical knowledge.

The objectives of the course are to instill in students solid skills for solving mathematical problems with bringing the solution to a practically acceptable result. Develop primary skills of mathematical research of applied questions and the ability to independently understand the mathematical apparatus contained in the literature related to the student’s specialty.

BRIEF DESCRIPTION OF THE COURSE

The course “Mathematics II” provides an accessible exposition of sections: elements of linear algebra and analytic geometry, differential calculus of functions of many variables, multiple integrals. “Mathematics II” is a logical continuation of the “Mathematics I” course.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

The study of this discipline will allow to put into practice the received theoretical knowledge and skills with a high degree of their understanding within the sections of the course, to use them at an appropriate level; translate into mathematical language the simplest problems posed in terms of other subject areas; acquire new mathematical

knowledge using educational and information technologies; solve applied problems in the field of professional activity

Mathematics III

CODE – MAT00123

CREDIT – 3 (1/0/2/3)

PREREQUISITE – Mathematics I, Mathematics II

GOAL AND OBJECTIVES OF THE COURSE

The purpose of teaching the course "Mathematics III" is the formation of basic knowledge and skills with a high degree of understanding of the sections of the course, helping to analyze and solve theoretical and practical problems.

Course objectives: instilling in students the skills to independently study educational literature, to carry out probabilistic and statistical analysis of applied problems; development of logical thinking and increasing the general level of mathematical culture.

BRIEF DESCRIPTION OF THE COURSE

The course "Mathematics III" includes sections: theory of series, elements of probability theory and mathematical statistics, and is a logical continuation of the discipline "Mathematics II".

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

Student

must know:

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

should be able to:

- Solve problems in all sections of the theory of series;
- find the probability of events;
- find the numerical characteristics of random variables;
- use statistical methods for processing experimental data;

Physics I, II

CODE – PHYS111-112

CREDIT – 6 (2/2/2/6)

PREREQUISITE – diagnostic test/PHYS110-111

GOAL AND OBJECTIVES OF THE COURSE

The main objective of teaching the course Physics I and Physics II is to form ideas about the modern physical world picture and the scientific worldview.

BRIEF DESCRIPTION OF THE COURSE

The disciplines of Physics I and Physics II are the basis of theoretical training for engineering and technical activities of graduates of higher technical schools and represent the core of the physical knowledge necessary for an engineer operating in the world of physical laws.

The course "Physics 1" includes the following sections: physical fundamentals of mechanics, the structure of matter and thermodynamics, electrostatics and electrodynamics. The discipline "Physics II" is a logical continuation of the study of the discipline "Physics 1", and forms a holistic view of the course of general physics as one of the basic components of the general theoretical training for bachelors of engineering and technical profile. The discipline "Physics II" includes the following sections: magnetism, optics, nanostructures, fundamentals of quantum physics, atomic and nuclear physics.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

the ability to use the 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.

Contemporary history of Kazakhstan

CODE – HUM100

CREDIT – 3 (1/0/2/3)

PREREQUISITE – no

GOAL AND OBJECTIVES OF THE COURSE

The purpose of the course is to familiarize students of technical specialties with the main theoretical and practical achievements of national historical science on the problems of the history of modern Kazakhstan, a comprehensive and systematic study of the main stages of the formation and development of Kazakhstani society.

- analyze the features and contradictions of the history of Kazakhstan in the Soviet period;
- to reveal historical content of foundations of the laws of political, socio-economic, cultural processes at the stages of formation of an independent state;
- contribute to the formation of students' citizenship;
- educate students in the spirit of patriotism and tolerance, belonging to their nation, the Fatherland;

BRIEF DESCRIPTION OF THE COURSE

The course Modern history of Kazakhstan is an independent discipline and covers the period from the beginning of the twentieth century to the present day. Modern history of Kazakhstan is studying the national liberation movement of the Kazakh intelligentsia at the beginning of the 20th century, the creation of the Kazakh Autonomous Soviet Socialist Republic, as well as the process of the formation of a multi-ethnic society.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

- knowledge of events, facts and phenomena of the modern history of Kazakhstan;
- knowledge of the history of ethnic groups inhabiting Kazakhstan;
- knowledge of the main stages of the formation of Kazakh statehood;
- ability to analyze complex historical events and predict their further development;
- ability to work with all kinds of historical sources;
- ability to write essays and scientific articles;
- ability to operate with historical concepts;
- ability to lead a discussion;
- skills of independent analysis of historical facts, events and phenomena;
- public speaking skills.

Kazakh/Russian language

CODE – LNG101

CREDIT – 5 (0/0/5/5)

PREREQUISITE – diagnostic test

GOAL AND OBJECTIVES OF THE COURSE

- to teach students to perceive aurally statements on familiar topics related to home, study, free time;
- understand texts on personal and professional topics containing the most frequent words and phrases;
- be able to have a conversation on everyday topics; describe your experiences; tell your opinion; retell and evaluate the content of the book read, the film seen;
- be able to create simple texts on known topics, including those related to professional activities.

BRIEF DESCRIPTION OF THE COURSE

The language material of the course is selected in such a way that the student, mastering the lexical and grammatical minimum, has the opportunity to get acquainted with typical communicative situations and he himself has turned out in

such situations to be able to evaluate them correctly and choose the appropriate model (strategy) of speech behavior.

The main focus of the course is carried through the process of transferring knowledge to learning the ability to use the target language in the implementation of various types of speech activity, such as reading (subject to read), listening (under the same condition) and producing texts of a certain complexity with a certain degree of grammatical and lexical correctness.

Materials for the classes are selected so that students who study Kazakh / Russian language acquire the skills of reading, writing and understanding speech based on a general knowledge of the basics of grammar (phonetics, morphology and syntax) and phrases in the process of constant repetition with the gradual complication of tasks.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

The student, on the condition of active organization of work in the classroom and conscientious homework by the end of the first semester, acquires skills and abilities corresponding to the European level A2 (Threshold by ALTE classification), that is, it turns out to be on the threshold of independent language proficiency.

English

CODE – LNG1051-1057

CREDIT – 12 (0/0/12/12)

PREREQUISITE – diagnostic test/LNG1051-1056

LNG1051

GOAL AND OBJECTIVES OF THE COURSE

Discipline “Beginner English” is intended primarily for learning from scratch. This course is also suitable for those who have only 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 achieve basis for improvement of their skills at the next stage of learning English.

Post requisites of the course: Elementary English.

LNG1052

GOAL AND OBJECTIVES OF THE COURSE

Discipline “Elementary English” is the foundation of learning English, 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 grammatical rules and learning the pronunciation and elementary vocabulary, as well as the promotion of self-study and critical thinking.

Course Prerequisites: Beginner English.

Post requisites of the course: General English 1.

LNG1053

GOAL AND OBJECTIVES OF THE COURSE

The goal of the “General English 1” course is to provide students with the opportunity to gain sufficient knowledge in order to become more free in everyday social and academic conditions. Students work on improving pronunciation, vocabulary and grammar. At this level, the main task is to consolidate the skills acquired earlier, learn how to make and correctly apply complex syntactic constructions in English, and also to achieve really good pronunciation.

Course prerequisites: Elementary English.

Post requisites of the course: General English 2.

LNG1054

GOAL AND OBJECTIVES OF THE COURSE

“General English 2” course is designed for students who continue to study “General English 1”. The course is focused on the ability to actively use in practice most aspects of English, conditional sentences, passive voice phrases, etc. At this stage, the student will be able to maintain a conversation with several people or express his point of view. The student expands his vocabulary, which allows him to freely express his thoughts in any setting. At the same time, the speech will be replenished with various synonyms and antonyms of familiar words, phrases and stable expressions.

Course Prerequisites: General English 1.

Post requisites of the course: Academic English.

LNG1055

GOAL AND OBJECTIVES OF THE COURSE

The main purpose of the course “Academic English” is to develop academic language skills. Discipline is a language style that is used in writing academic works (paragraph, abstract, essay, presentation, etc.). This course is designed to help students become more successful and effective in their studies by developing critical thinking and independent learning skills.

Course Prerequisites: General English 2.

Post requisites of the course: Professional English

LNG1056

GOAL AND OBJECTIVES OF THE COURSE

“Business English” is English for business communication and career. Knowledge of business English is useful for negotiating and business correspondence, preparing presentations and informal communication with business partners.

Features of training are that it is necessary not only to master the vocabulary, but also to learn new skills: presentation, communication, language, professional.

Course Prerequisites: IELTS score 5.0 and / or Academic English

Post requisites of the course: Professional English, IELTS score 5.5-6.0

LNG1057

GOAL AND OBJECTIVES OF THE COURSE

“Professional English” course is designed for B2+ students whose goal is to enhance students' language competence in relevant professional areas. The main objective of the course is to teach students to work with texts, both audio and written, in their specialty. The curriculum is built on the necessary vocabulary (words and terms), often used in English for special purposes. Students will acquire proficiency in English through integrated learning based on content and language, learn vocabulary in order to read and understand original sources with a high degree of independence, and practice various communication patterns and vocabulary in specific professional situations.

Course prerequisites: Business English.

Post requisites of the course: any elective course.

Information and communication technology (in English)

CODE – CSE174

CREDIT – 3 (2/1/0/3)

PREREQUISITE – no

GOAL AND OBJECTIVES OF THE COURSE

Teach to apply modern information technologies in the field of professional activity. Course objectives include:

- Expand the basic concepts of computer systems architecture;
- To reveal the basic concepts of information and communication technologies and subject terminology;
- To teach working with software interfaces of operating systems;
- To teach how to work with data in a variety of views, both in tabular structured and unstructured form
- Teach to apply the basic principles of information security;
- Expand the concepts of data formats and multimedia content. To teach how to work with standard multimedia data processing applications. Use modern approaches to the presentation of the material;
- Expand the concept of modern social, cloud and email platforms and ways to work with them;

- Train to use algorithmic and programming methods for solving problems of automating business processes

BRIEF DESCRIPTION OF THE COURSE

The course contains a study 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 Sample Curriculum of SCES, with a predominance of education of practical skills in working with data, algorithms and programming. The course is designed in such a way that would teach students not only the basic concepts of architecture and modern infrastructure of information and communication technologies, but also teach how to use these tools to solve problems of an applied nature. Teach how to optimize processes, apply adequate models and methods for solving practical problems using modern methods and tools of information technologies, automate routine processes, be productive and efficient.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

Students will know:

- Computer architecture;
- Architecture of computing systems
- Information and communications technology infrastructure;
- 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 for data protection;
- Python programming language

Students will be able to:

- Work with interfaces of modern operating systems;
- Work with modern application software to work with data of various nature and purpose;
- Use modern social, cloud, email platforms for organizing business processes;
- Program in an algorithmic programming language;
- Analyze, model, design, implement, test and evaluate information and communication technology systems

Philosophy

CODE – HUM124

CREDIT – 3 (1/0/2/3)

PREREQUISITE – Modern history of Kazakhstan

GOAL AND OBJECTIVES OF THE COURSE

The purpose of the course is the formation of cognitive, operational, communicative, self-educational competencies.

to solve problems:

- contribute to the development of adequate ideological orientations in the modern world;
- to form a creative and critical thinking among students;
- to distinguish between spiritual and material values and their role;
- contribute to the definition of their attitude to life and the search for harmony with the outside world

BRIEF DESCRIPTION OF THE COURSE

"Philosophy" is the formation of a holistic worldview which developed in the context of the socio-historical and cultural development of mankind. Familiarity with the main paradigms of teaching philosophy and education in the classical and post-classical traditions of philosophy. Philosophy is designed to develop sustainable life guidelines, finding the meaning of being as a special form of spiritual production. Contributes to the formation of the moral image of the individual with the ability of critical and creative thinking. The theoretical sources of this course are the concepts of Western, Russian, and Kazakhstani scholars in history and theory of philosophy

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

- knowledge of basic terms, main concepts and problems of philosophy;
- knowledge of the main philosophical ways of solving worldview issues in the context of culture;
- ability to analyze the history of the development of philosophical thought;
- ability to identify alternative ways of posing and solving worldview questions in the history of human development;
- ability to identify the main theoretical approaches in the relationship between man and society;
- ability to master the technique of performing independent work;
- research skills and systematization of the material;
- skills to discuss freely and make rational decisions;
- skills of ethical principles in professional activities.

Ordinary differential equations

CODE – MAT00124

CREDIT – 3 (1/0/2/3)

PREREQUISITE – Mathematics I-III

GOAL AND OBJECTIVES OF THE COURSE

The purpose of teaching the course “Ordinary Differential Equations. Matlab” is the formation of basic knowledge of sections of the course, helping to analyze, model and solve theoretical and practical problems using both analytical and numerical methods using Matlab; instilling in students the ability to independently study educational literature.

Course objective is to teach to recognize the types and forms of integrable equations and systems, integrate them and apply differential equations for the mathematical solution of applied problems.

BRIEF DESCRIPTION OF THE COURSE

Ordinary 1st order differential equations. Ordinary differential equations of higher orders. Systems of differential equations. Linear equations with variable coefficients. Numerical integration of differential equations and systems. Use Matlab to solve differential equations numerically.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

- master the methods of solving ordinary differential equations;
- set math problems;
- be able to build mathematical models;
- be able to solve problems modeled by differential equations using both analytical and numerical methods using Matlab

Partial differential equations. MatLab

CODE – MAT00125

CREDIT – 3 (1/0/2/3)

PREREQUISITE – Mathematics I-III, Ordinary differential equations. Matlab

GOAL AND OBJECTIVES OF THE COURSE

The aim of teaching the course “Partial differential equations. Matlab” is the formation of basic knowledge of the sections of the course, helping to analyze, model and solve theoretical and practical problems.

Course objectives: apply the theory of partial differential equations to solve and study applied problems from various fields of natural science, economics, medicine, biology and ecology; form ideas about the implementation of numerical methods for solving boundary value problems using Matlab

BRIEF DESCRIPTION OF THE COURSE

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 the numerical solution of boundary value problems.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

- to master this mathematical apparatus, which allows to analyze, model and solve classical boundary value problems;
- master the methods of solving classical boundary value problems;
- be able to pose a problem, choose solution methods, both in analytical form and using computer technologies;
- use modern software package Matlab;
- to master the methodology and skills of numerical implementation of a mathematical model, analysis of the results obtained, their interpretation to refine the model;
- independently expand their mathematical knowledge.

Engineering and Computer Graphics

CODE – GEN101

CREDIT – 3 (1/0/2/3)

PREREQUISITE – no

GOAL AND OBJECTIVES OF THE COURSE

- development of spatial representation and imagination, constructive-geometric thinking, ability to analyze and synthesize spatial forms and relationships based on graphical models of space;
- teaching students how to work with graphical information of various kinds and contents, the basics of graphic presentation of information, methods of graphical modeling of geometric objects, rules for developing and designing design documentation, graphical models of phenomena and processes;
- students mastering the methods and tools of computer graphics, the acquisition of knowledge and skills to work with the computer-aided design system AutoCAD.

BRIEF DESCRIPTION OF THE COURSE

The study of ways to obtain certain graphical models of space based on orthogonal projection and the ability to solve problems connected with spatial forms and relations on these models. Mastering the basic principles and methods of geometric modeling and methodology for the development of graphic applications. Mastering the knowledge of constructing a drawing, the ability to read and write graphic and text design documentation in accordance with the requirements of regulatory documents, state standards. Acquaintance of students with the concept of computer graphics,

geometric modeling, graphic objects, with modern interactive graphic systems for solving automation tasks of drawing and graphic works on the example of AutoCAD.

Formation of skills to use universal graphic systems for the development and editing of drawings using three-dimensional computer modeling, design automation in relation to the development and implementation of design documentation.

KNOWLEDGE AND SKILLS AFTER COURSE COMPLETION

As a result of studying the discipline, the student should know:

- theoretical foundations for complex and axonometric drawings;
- methods for constructing images - views, cross-sections, sections - of both existing and newly created products;
- rules for the execution and formatting of drawings, drafting design and text documents established by state standards;
- types of connection of component parts of products, their conventional images and designations;
- methods for constructing surface sweeps

be able to:

- build complex and axonometric drawings of geometric images;
- prepare textual and graphical design documentation;
- read the assembly drawing and prepare working drawings and sketches in accordance with state standards;
- navigate freely in projections with numerical marks;
- work in a universal AutoCAD environment with both 2M views and 3M objects.

have skills:

- perform and read the assembly drawing;
- construction of flat projection models of three-dimensional space;
- solutions of positional and metric problems;
- possession of modern computer-aided design tools.

have the following competencies:

- the ability to apply the methods of graphic representation of objects of professional activity, for example, engineering objects, schemes and systems;
- willingness to use information technology, including modern computer graphics, in its subject area;
- readiness to participate in the development of project and working design documentation in accordance with standards, specifications and other regulatory documents.

Social & Political Knowledge

THE CODE – HUM126

THE CREDIT – 4 (4/0/0/4)

PREREKVIZIT – no

This course involves the study of four scientific disciplines - psychology, political science, sociology and cultural studies, each of which has its subject, terminology and research methods. Interactions between these scientific disciplines are carried out based on the principles of information complementarity; integrability; methodological integrity of research approaches of these disciplines; generality of result-oriented teaching methodology; unified system representation of the typology of learning outcomes as formed abilities.

The theoretical sources of this course are the concepts of Western, Russian, and Kazakh scientists in the field of sociology, political science, and cultural studies.

Theory of inventive problem solving (TRIZ)

THE CODE IS ELC 200

THE CREDIT – 3 (2/0/1/3)

PREREKVIZIT – no

PURPOSE AND PROBLEMS OF THE COURSE

Training of students in bases of search of engineering solutions of technical contradictions when developing, to design and operation and at their modernization. Besides, at students it is necessary to form the culture of creative thinking, elaboration of ideas of an essence of the natural, technical phenomena and their interrelation, ability to make the scientific reasoned reasonings, finding of experience in the analysis of inventive tasks

SHORT DESCRIPTION OF THE COURSE

Idea of trends of development of methods of solutions of inventive tasks, of creative approach at the solution of problems, about an essence and types of contradictions, about methods of resolution of conflicts of technical systems, in particular electronic engineering. Receptions of the solution of inventive tasks, vepolny analysis of tasks, drawing up model of a technical system, drawing up algorithms of the solution of tasks, technical contradictions, methods of search of the ideal end result. Classification of physical contradictions, methods of application of information fund, methods of mobilization and application of resources, morphological analysis. Algorithms of the solution of inventive tasks. Methods of approbation of the solution of inventive tasks.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

Разработано:	Рассмотрено: заседание УС Института	Утверждено: УМС КазННТУ	Страница 30 из 55
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As a result of studying of discipline the student has to:

- to have an idea of the main methods and methods of TRIZ: about methods of brainstorming, and its versions, methods of resolutions of conflicts, system approach in creativity, personal analogy, the morphological analysis;
- to know the basic concepts of TRIZ: веполь, technical contradiction, ideal end result, physical contradiction, information fund, algorithm of the solution of inventive tasks
- to be able to apply the main categories, concepts of practical activities to the analysis of a specific objective; to make models of a technical system; to apply information fund to the solution of tasks; to carry out the morphological analysis of a specific inventive objective

Theoretical Foundations of Electrical Engineering I

THE CODE – ELC 165

THE CREDIT – 3 (2/1/0/3)

PREREKVIZIT – Physics of I

PURPOSE AND PROBLEM OF THE COURSE

The discipline purpose "Theoretical bases of electrical equipment I" is assimilation of modern methods of modeling of electromagnetic processes, methods of the analysis and synthesis of electrical circuits; mastering by students of the basic concepts and laws of the Theory of electrical circuits of their communication with the general philosophical, mathematical and logical concepts which knowledge is necessary for understanding and a successful solution of engineering problems of future specialty.

Studying of TFEE-I should contribute to the development of scientific intelligence of the modern engineer of telecommunication communication and radio as in discipline of thermal power plant such questions as generation, transfer and conversion of the electric power and electric signals, transfer and information transform, and implementation of communication at distance with use of electromagnetic waves are studied.

SHORT DESCRIPTION OF THE COURSE

The discipline "Theoretical bases of electrical equipment I" according to the curriculum of the direction of training of bachelors "Electronics and electrical equipment", is one of basic disciplines in the system of training of specialists in the field of radio engineering. When studying this discipline the foundation of knowledge allowing to use skillfully modern element base of electrical equipment, to understand trends and perspectives of its development and practical use is laid, skills of calculation of the modes of active devices in electro technical chains, a pilot study of their

characteristics and parameters, creation of anchor cells of the electrotechnical chains containing such devices are gained.

This course has applied relevance and their applied application for creation, transfer and electric power distribution as universal intermediary between power sources and consumers, for a solution of problems of transfer and distribution of information, electronics, automatic equipment, telemechanics, information and measuring and ADP equipment.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of discipline students should:

- nobility: the basic concepts and definitions used in electrical circuits, fundamental laws, methods of the analysis of electrical circuits in the set and transient regimes, conditions of passing of a signal through certain sections or elements of a chain, distribution of electromagnetic wave at the stationary and not stationary modes;
- be able: work out equations of state of a chain, characterizing work of a chain, calculate currents in branches and tension on sections at the set parameters, to calculate transition processes in chains with one and several drives of energy, to carry out the analysis of nonlinear chains, to analytically describe signals and to give an assessment to their key temporary and power parameters, to design a chain of the set configuration;
- receive skills to calculate and measure currents in branches and tension on sections at the set parameters.

Theoretical Foundations of Electrical Engineering II

THE CODE – ELC166

THE CREDIT – 3 (2/1/0/3)

PREREKVIZIT – Theoretical Foundations of Electrical Engineering I

PURPOSE AND PROBLEM OF THE COURSE

The purpose of teaching discipline "Theoretical Foundations of Electrical Engineering II" is assimilation of modern methods of modeling of electromagnetic processes, methods of the analysis and synthesis of electrical circuits; mastering by students of the basic concepts and laws of the Theory of electrical circuits of their communication with the general philosophical, mathematical and logical concepts which knowledge is necessary for understanding and a successful solution of engineering problems of future specialty.

Studying of TFEE-II should contribute to the development of scientific intelligence of the modern engineer of telecommunication communication and radio as in discipline of combined heat and power plant such questions as generation, transfer and conversion of the electric power and electric signals, transfer and information transform, and implementation of communication at distance with use of electromagnetic waves are studied.

SHORT DESCRIPTION OF THE COURSE

The discipline "Theoretical bases of electrical equipment – Part 2" according to the curriculum of the direction of training of bachelors "Electronics and electrical equipment", is one of basic disciplines in the system of training of specialists in the field of electronics and electrical equipment.

This course has applied relevance and their applied application for creation, transfer and electric power distribution as universal intermediary between power sources and consumers, for a solution of problems of transfer and distribution of information, transition processes in magnetic circuits, the systems of transformer providing.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of discipline students should:

nobility: the basic concepts and definitions used in electrical circuits, fundamental laws, methods of the analysis of electrical circuits in the set and transient regimes, conditions of passing of a signal through certain sections or elements of a chain, distribution of electromagnetic wave at the stationary and not stationary modes;

- be able: work out equations of state of a chain, characterizing work of a chain, calculate currents in branches and tension on sections at the set parameters, to calculate transition processes in chains with one and several drives of energy, to carry out the analysis of nonlinear chains, to analytically describe signals and to give an assessment to their key temporary and power parameters, to design a chain of the set configuration;

This course has applied relevance and their applied application for creation, transfer and electric power distribution as universal intermediary between power sources and consumers, for a solution of problems of transfer and distribution of information, electronics, automatic equipment, telemechanics, information and measuring and ADP equipment.

Physical fundamentals of electronics

THE CODE – ELC 196

THE CREDIT – 3 (1/1/1/3)

PREREKVIZIT – Physics of I, Theory of electrical circuits

PURPOSE AND PROBLEMS OF THE COURSE

The course purpose – forming at students of knowledge of operation principles, parameters and characteristics of the main classes of modern semiconductor devices and integrated circuits and the modes of their work; forming at students of knowledge of fundamentals of circuit engineering of the analog electronic devices (AED) and methods of their analysis and also skills of the choice and creation of the AEU nodes; studying of the measuring technologies integrating set of methods, approaches,

program and logical providing to the organization of measurements; statuses and trends of development of measuring means and main methods of measurement of characteristics of electronic chains and signals, assessment of their accuracy.

SHORT DESCRIPTION OF THE COURSE

Physics of semiconductors. Semiconductor diodes. Transistors. Light-wave semiconductor devices. Microelectronics, integrated circuits (IC). Logical and linear integrated circuits. Indicators and characteristics of analog electronic devices. Principles, assignment and types of the feedback coupling (FC). Power amplifiers. Differential cascade. Operational amplifiers. Devices of analog signal processing. The inverting and not inverting amplifiers on OU. Active RC filters. Signal converters. Comparators and generators of electric fluctuations. Metrology. Measurements and measuring technologies. Digital instruments. Standardization and certification. Basic concepts, terms and definitions. Legislative base of certification.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of discipline the student should:

- nobility: features, key parameters and manufacturing techniques of electronic instruments and chips, classification of electronic instruments and chips; classification and the principles of functioning of the main analog devices and their basic elements, features and key parameters of differential and operational amplifiers, linear and nonlinear circuits on the basis of operational amplifiers with feedback couplings, legal and organizational and methodical bases of standardization, metrology and certification of products, services and quality systems;

- be able: build the simplest electronic circuits on electronic instruments and chips, to select element base for a specific scope of devices, to build multistage amplifiers, decisive amplifiers, active filters, generators of sine and relaxation wave oscillations, transformers, comparators and to carry out calculations of AEU, to define the main characteristics and parameters of electrical circuits and signals;

- have experience: removals of the main characteristics of electronic instruments and chips, the main characteristics of amplifiers (amplitude-frequency, phase-frequency, amplitude) and determination of parameters of different analog circuits, the choice of element base, use of properties of measurements in different practical areas;

- have an idea: about trends and perspectives of development of element base micro, opto-and a nanoelectronics, about operation principles of modern analog integrated microcircuits, about features of circuit engineering of the analog devices considering their implementation on integrated technology and ensuring stability of their work about classification of electrical measuring instruments, the principles of their action, features and the key metrological parameters; about processing of results

of measurements to give an assessment to the accuracy of means and results of measurements.

Signal Transmission Theory

THE CODE – ELC401

THE CREDIT – 3 (1/1/1/3)

PREREKVIZIT – Information and communication technology

PURPOSE AND PROBLEMS OF THE COURSE

The aim of the course is to form knowledge on the basics of signal theory and their application to the optimization of modern systems of electronics and electrical engineering. The objective of the course is to familiarize students with the main processes that occur when converting messages into a signal and their transmission through channels and communication lines.

SHORT DESCRIPTION OF THE COURSE

General information about the formation and transmission and reception of signals in transmission systems (classification of signals, description of signals, processing and transmission of analog and digital signals). Signal transmission and processing; regularities defining properties of signals and transmission of their functioning. Elements of transmission systems and types of signals; communication channels and their characteristics; purpose and main types of modulations and demodulations; methods and devices for error-correcting coding.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

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

Know:

- the physical essence of the processes occurring in communication channels, cascades and nodes for signal conversion and processing;
- types and description of signals, processing and transmission of analog and digital signals.

Be able to:

- determine and calculate the main characteristics and determine the parameters of various signals;
- to analyze and synthesize signals.
- be able to analyze models of building communication channels, characteristics (indicators) of devices and systems for analog and digital signal processing;

Be competent:

- possess the skills of methodological analysis of signals and communication channels.

- to acquire practical skills in calculating the electrical parameters of signals, constructing time and spectral diagrams of signals, researching the main processes in communication systems.

Fundamentals of Automation

THE CODE – AUT 146

THE CREDIT – 3 (2/1/0/3)

PREREKVIZIT – Physics I

PURPOSE AND PROBLEMS OF THE COURSE

The purpose of the course "Automation Bases" is statement of bases of the modern theory of automatic control of linear and nonlinear systems. A problem of a course is also formation at students of practical skills to creation of mathematical models on the basis of a formalism of the theory of automatic control

SHORT DESCRIPTION OF THE COURSE

General information about the systems of automatic control. Linearization of the differential equations of systems of automatic control. Transfer function of a dynamic link. Temporary and frequency characteristics of a dynamic link. Logarithmic frequency characteristics of a dynamic link. Standard links of systems of automatic control and their characteristic. Concept of stability of linear systems. Creation of areas of stability. Indicators of quality of regulation of linear systems.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of development of discipline the student has to:

- nobility: methods of the description of systems of automatic control in the form of transfer functions; creation of temporary and frequency characteristics of systems of automatic control; methods of a research of stability of linear systems of automatic control and management; methods of assessment of quality of process of regulation.

- to be able: - to make block diagrams of systems of automatic control; to conduct a research of stability of linear systems of automatic control.

- to own: to carry out the analysis and calculation of key indicators:

stability, qualities, reliability and technical and economic efficiency of work of systems of automatic control with use of computer aids;

- to be competent: in questions of the choice of elements of a system of automatic equipment to analyze and calculate the main of indicators of stability, quality, reliability and technical and economic overall performance of systems of automatic control.

Optics in telecommunications

THE CODE – ELC420

THE CREDIT – 3 (2/0/1/3)

PREREKVIZIT – Signal Transmission Theory

The **PURPOSE AND PROBLEMS** of the **COURSE** – statement of the principles and transmission methods of signals on fiber optic cables, scientific bases and the current state of the fiber optic communication system.

SHORT DESCRIPTION OF THE COURSE

Types and the main types of optical linear constructions of communication, their constructive, utilization properties, electric parameters are considered; requirements to bandwidth; model of a fiber transmission system; optical plugs, joints and passive optical devices; multiplexing with division longwise waves; technological processes at operation, repair and construction of optical linear constructions; safety regulations during the work on lines.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of this discipline the student should:

nobility:

- operation principle, functional diagrams, constructive devices of the main nodes of the SMALLPOX equipment;
- bases of the theory, calculation and operation of fiber optic cables and systems of a fiber line of communication of the enterprises and objects of telecommunication;
- main technical characteristics, functional diagrams, construction of the OSP modern equipment;

be able:

- perform measurements of key parameters of canals and highways of SMALLPOX;
- analyze results of measurement and set their compliance to existing rules;
- read skeleton diagrams and functional diagrams of the main nodes of the TsVOSP equipment;
- to accurately represent the main directions and perspectives of development of systems and technologies of communication, to know the organization of the enterprises of telecommunication, key parameters and requirements of a fiber line of communication.

Circuitry of electronic means

THE CODE - ELC402

THE CREDIT – 3 (1/1/1/3)

PREREKVIZIT – Physical fundamentals of electronics

PURPOSE AND PROBLEMS OF THE COURSE – studying of the principles of operation of amplifiers, generators and different transformers, their parameters and

volt ampere characteristics and also principles of creation of the intensifying, switching, generating and digital circuits on discrete semiconductor devices as diodes and transistors, and in integrated execution.

SHORT DESCRIPTION OF THE COURSE

The basic principles of creation of electronic circuits, the principles of functioning of gain and converting stages, generators of signals, electrical wave filters, the principles of work of integrated microcircuits, different aspects of use of element base of electronics in practical activities are considered. For this purpose in detail the principles of operation of different amplifiers on transistors and also integrated versions of amplifiers like differential cascades and operational amplifiers, their schematic execution is considered.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of a course the student should master the basic principles of creation of electronic circuits, the principles of functioning of gain and converting stages, generators of signals, electrical wave filters, the principles of work of integrated microcircuits, different aspects of use of element base of electronics in practical activities.

As a result of studying of discipline the student should:

- nobility: classification and the principles of functioning of the main devices and their basic elements, features and key parameters of differential and operational amplifiers, linear and nonlinear circuits on the basis of operational amplifiers with feedback couplings;
- be able: build multistage amplifiers, decisive amplifiers, active filters, sine wave generators, transformers, comparators and to carry out calculations of EU;
- have experience: removals of the main characteristics of amplifiers (amplitude-frequency, phase-frequency, amplitude) and determination of parameters of different analog circuits, choice of element base;
- have an idea: about an operation principle of modern integrated microcircuits, about features of circuit engineering of the analog devices considering their implementation on integrated technology and ensuring stability of their work.

Electrotechnical materials

THE CODE – ELC406

THE CREDIT – 3 (2/0/1/3)

PREREKVIZIT – Theoretical Foundations of Electrical Engineering I, II

PURPOSE AND PROBLEMS OF THE COURSE

study the main groups of electrotechnical materials: conductors, dielectrics, semiconductors and magnetic materials and also materials with special characteristics

of thermal expansion and special elastic characteristics. Study a physical entity of the phenomena happening in materials in interaction to an electromagnetic field, the main electrophysical characteristics of materials and influence on them of different factors, features of technology of receiving materials and their application in electrotechnical and radio-electronic devices, elements of automatic equipment and devices.

SHORT DESCRIPTION OF THE COURSE

Electrotechnical materials studies the main physical phenomena proceeding in materials at impact on them of electromagnetic fields, properties of materials, the production technology. Development of new materials happens along with the general development of electrical equipment when the increasing value gets the right choice of materials allowing to solve successfully arising problems. The problem of modern level consists in creation of the quality electrotechnical materials which are completely meeting the latest requirements.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of this discipline the student should:

nobility:

- operation principle of electrotechnical materials;
- bases of the theory, calculation and operation of electrotechnical materials, insulating materials;
- main technical characteristics, functional diagrams, classification of electrotechnical materials;

be able:

- perform measurements of key parameters of electrotechnical materials;
- analyze results of measurement and set their compliance to existing rules;
- read skeleton diagrams and functional diagrams of electrotechnical materials;
- to accurately represent the main directions and perspectives of development of electrotechnical materials, to know key parameters and requirements of electrotechnical materials.

Optoelectronics

THE CODE – ELC407

THE CREDIT – 3 (1/0/2/3)

PREREKVIZIT – Circuitry of electronic means

PURPOSE AND PROBLEMS OF THE COURSE

studying of physical bases and principles of operation of active devices of optical systems of transfer and information processing (lasers, photodetectors, modulators, deflectors, etc.).

SHORT DESCRIPTION OF THE COURSE

Optical electronics is the scientific and technical direction connected with studying of interaction of optical radiation with electrons in substance, generally in solid bodies for creation of the light-wave devices which are carrying out conversion of electric signals to optical (junction lasers and light-emitting diodes) and optical signals in electric (photodetectors of different types).

Devices of quantum and optical electronics find broad application in modern optical systems of transfer, processing, storage and information display.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of this discipline the student should:

know:

- operation principle, functional diagrams, constructive devices of the main of optoelectronic devices;

- bases of the theory, calculation and operation of devices of optical electronics;

- order of conversion of a signal, principles of operation of light-wave devices;

- main technical characteristics, functional diagrams, construction of the modern equipment of optoelectronics;

be able:

- perform measurements of key parameters of light-wave devices;

- analyze results of measurement and set their compliance to existing rules;

- read skeleton diagrams and functional diagrams of optoelectronic devices;

- to accurately represent the main directions and perspectives of development of optoelectronic systems, to know key parameters and requirements of light-wave devices.

Fundamentals of power electronics

THE CODE – ELC188

THE CREDIT – 3 (1/1/1/3)

PREREKVIZIT – Circuitry of electronic means

PURPOSE AND PROBLEMS OF THE COURSE

Studying of the course " Fundamentals of power electronics" is the purpose mastering of physical bases of power electronics and the principles of work of elements of power electronic devices.

SHORT DESCRIPTION OF THE COURSE

Basic elements of power electronics. Transition processes. Linear transformer power sources. Rectifiers. Rectifier filters of a power supply. Power conditioners. Tension transformers. Voltage multipliers. Dimmers. Accumulators and chargers. Regulators and stabilizers of frequencies. Power factor correctors. Electronic

stabilizers. Invertor stabilizers. Baristora. Snabbera. Methods of a solution of technical issues of power electronics. Solution of creative problems of the first level of complexity. Methods of a solution of creative problems of the second level of complexity. Features of use of undriven elements in power electronics.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of the course "Bases of Power Electronics" the student should:

nobility:

- operation principle, functional diagrams, constructive devices of basic elements of power electronics;
- bases of the theory, calculation and operation of devices of power electronics;
- principles of operation of electronic instruments;
- main technical characteristics, functional diagrams, construction of the modern equipment of power electronics;

be able:

- perform measurements of key parameters of power electronic instruments;
- analyze results of measurement and set their compliance to existing rules;
- read skeleton diagrams and functional diagrams of power electronic devices;

Microprocessor and microcontroller devices and systems

THE CODE – ELC 403

THE CREDIT – 3 (1/1/1/3)

PREREKVIZIT – Circuitry of electronic means

PURPOSE AND PROBLEMS OF THE COURSE

The purpose of the course "Microprocessor and Microcontroller Devices and Systems" is forming of knowledge of bases of the microprocessor and microcontroller equipment. A problem of a course acquaintance of students with the main structure and coding environment of microprocessors and microcontrollers for effective work of hardware means of electrical equipment.

SHORT DESCRIPTION OF THE COURSE

General information about structure of microprocessors and a microprocessor system. Architecture and classification of modern microprocessors and microcontrollers. Structure and main characteristics of the microcontroller. Coding environment of the microcontroller and microprocessor. Structure of the central processor and memory of the microcontroller. Addressing modes of data and commands. Peripheral devices of the microcontroller classification and assignments. Interface and types of transfer of the microcontroller.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of discipline should know:

- structure and architecture of modern microprocessors and microcontrollers;
- instruction set and methods of addressing of the microcontroller;
- peripheral devices and interface of the microcontroller.

As a result of studying of discipline the student should be able:

- use microprocessors and microcontrollers at design of a microprocessor system;
- be competent:
 - own methods, receptions and technology of development of the special software for microprocessor systems of management;
 - own bases programming of microcontrollers for creation of microprocessor systems of management.

Electronic sensors and transducers

THE CODE IS ELC409

THE CREDIT – 3 (2/1/0/3)

PREREKVIZIT – Physical bases of electronics, Circuit designer of electronic means, Optoelectronics

PURPOSE AND PROBLEMS OF THE COURSE

Mastering basic knowledge on theoretical bases of electronic sensors and converters, their device, scopes, characteristics and parameters, the principles of their action, service conditions.

Problems of discipline – studying of physical bases and basic provisions of the theory of electronic sensors; acquisition of practical skills by calculation, the choice and operation of electronic sensors and converters.

SHORT DESCRIPTION OF THE COURSE

Acquaintance of students with the electronic sensors and converters used when using electric energy, beginning from its production, transfer, distribution and finishing consumption; their purpose, main characteristics and also scopes, principles of action, design.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of discipline students have to:

nobility:

- about the modern and perspective directions of development of electronic sensors and converters;
- about classification of electronic sensors;
- about scopes of different types of electronic sensors and converters;

- about a role of various electronic sensors and converters in improvement of quality and energy efficiency of power distribution, increase in productivity, decrease in operating costs and improvements of uninterrupted operation of power supply;

to be able:

- to analyze the physical phenomena proceeding in electronic sensors and converters;

- to build designs of various electronic sensors and converters, to know the principle of their action;

- to define the main characteristics and parameters of electronic sensors and converters;

to receive skills:

- descriptions of the analysis of the physical processes proceeding in electronic sensors and converters;

- to estimate efficiency and to choose type of electronic sensors and converters for specific conditions;

- to conduct elementary tests of electronic sensors and converters independently;

- to make predesign of parameters and the choice of electronic sensors and converters.

Programmable logic integrated circuits

THE CODE – ELC 410

THE CREDIT – 3 (2/0/1/3)

PREREKVIZIT – Microprocessor and microcontroller devices and systems

The **PURPOSE AND PROBLEMS** of the **COURSE** Obtaining Basic Knowledge about technologies and the systems of design automation of radio-electronic devices on COTTON VELVET base. Mastering of skills of design of the digital electronic devices (DED) on COTTON VELVET base.

SHORT DESCRIPTION of the **COURSE**. System approach to design of radio-electronic devices. Main signs of a system. Basic provisions of system approach in relation to design of TsEU. Classification and main properties of chips of a programmed logic. Recommendations about the choice of family and the COTTON VELVET type for the developed device. Design of digital devices on COTTON VELVET base of Xilinx with use of a packet of WEBPACK ISE. Structure of the project and a technique of creation of the new project in WebPACK ISE CAD. Creation of the circuitry description of the projectible device. Input of temporary and topological restrictions of the project. Synthesis of the project with use of means of a packet of WebPACK ISE. Use of the VHDL language for the description of the projectible device. Structure of the description of the device in the VHDL language. Definition of the functions and procedures used as a part of architecture of an object. Use of different

styles of determination of architecture of an object. In parallel and consistently carried out operators of the VHDL language. Functional modeling of the projectible device on COTTON VELVET base. Structure and ways of preparation of the test module of the project. Creation of the test module of the project in a text format and in the form of time diagrams. Stages of modeling of digital devices on COTTON VELVET base.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of mastering of discipline the student should:

nobility: Modern level of development COTTON VELVET and their functionality; Possibilities of systems of design automation of TsEU on COTTON VELVET base; Languages of the description of digital devices; Technology of design of TsEU; Technologies of automated design of TsEU

be able: Select architecture COTTON VELVET when developing new radio-electronic devices; Use automated design engineering systems of devices on COTTON VELVET base. Implement design stages of radio-electronic devices. Apply system approach to design of new radio-electronic devices. Work with scientific, technical and educational literature in this direction.

skills: Technology of debugging and testing of the programming modules intended for record in COTTON VELVET; Technology of debugging and testing of hardware modules for COTTON VELVET; By Methods of testing of the developed by radio and digital electronic devices.

Design of electronic means

THE CODE – ELC 412

THE CREDIT – 3 (2/1/0/3)

PREREKVIZIT – Circuit engineering of electronic means, Microprocessor and microcontroller devices and systems, Linear system of automatic control.

PURPOSE AND PROBLEMS OF THE COURSE

The purpose of discipline is acquisition of knowledge and practical skills in the development area and design of modern electronic technical products, their separate elements, bases of creation of technological processes of their production; protection of products against the external destabilizing factors.

Content of discipline is subordinated to requirements imposed when training the engineers specializing in the development area of means of metrological support, standardization, certification, the information and measuring equipment.

Problems of discipline - studying of the basic principles of creation of products, standard constructions and their elements, the modern principles of configuration, manufacturing techniques, assembly and control, requirements of standards for development of design documentation that will allow students to receive necessary

skills on development and design of electronic products and also to understand technical documentation.

SHORT DESCRIPTION OF THE COURSE

When studying this discipline the foundation of knowledge allowing to use skillfully modern element base of electronics, to understand trends and perspectives of its development and practical use is laid, skills of calculation of the modes of active devices in electronic chains, a pilot study of their characteristics and parameters, creation of anchor cells of the electronic chains containing such devices are gained.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

As a result of studying of discipline students should:

- know the basic principles of design, theoretical bases and modern information technologies of design and development of electronics; developments and manufacturing techniques of electronic technical products, requirements to execution of design and technological documentation according to requirements of standards (ESKD, etc.), criteria for evaluation of quality of again developed electronic product;

- be able to project and develop different types of electronic devices on the basis of the object-oriented approach; use the gained knowledge for design with set constructive and taking into account requirements for ensuring technological effectiveness, develop and make out project and technological documentation; estimate quality of the developed product, its technological effectiveness and safety for the user in the course of production and operation; read and develop drawings of engineering devices and the scheme of technological processes and also to project electronic products with the set constructive, operational properties;

- receive skills of design and development of electronic devices, development of technological processes, execution of technical documentation, use of technical and reference books and also estimates of quality of electronic systems.

- master techniques of use of software for a solution of design tasks

- justify the made design decisions, carry out setting and carry out experiments on check of their correctness and efficiency.

Intellectual networks

THE CODE – KTT 146

THE CREDIT – 3 (2/0/1/3)

PREREKVIZIT – Design of electronic means

PURPOSE AND PROBLEMS OF THE COURSE

Acquaint students with the concepts of the Intelligent Network of Communication (INC) allowing to provide supplementary telecommunication services, including, managed by the client.

SHORT DESCRIPTION OF THE COURSE

Concept of the Intelligent network. Interrelation of new technologies. Architecture of ISS: elements of network; services and attributes, global functional plane, distributed functional plane, physical plane. Model of service of a call. Interfaces and protocols. Questions of implementation of ISS. Perspectives of development of ISS.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

Nobility: concept and architecture of an intelligent network (IN); program component of implementation of services ISS; communication of the components providing provision of services of the IC; interfaces and protocols; scheme of interrelation of an intellectual superstructure with telecommunication network; process model of service of a call; classification and characteristic of intellectual services.

Be able: apply concepts of IN to the specification of services; organize access for subscribers to the IN platform equipment.

Have skills of design of intelligent information systems.

Project management in the electrical industry

the CODE – ELC 415

THE CREDIT – 3 (2/0/1/3)

PREREKVIZIT – no

PURPOSE AND PROBLEMS OF THE COURSE the Purpose of development of discipline "Project management in electrotechnical and electronic industry" is mastering students of technology of project management and productions of projects of electronic industry.

The main objectives of discipline are: studying of the basic principles of project management; acquaintance with the main technologies of project management and their opportunities; familiarization with computer technologies for the implementation of project management

SHORT DESCRIPTION of the COURSE. Modern concepts of project management. Basic concepts and definitions. International standards of project management. Initialization processes. Planning processes. Execution processes. Processes of monitoring and control. End processes. Management of contents of the project by the organization. Project duration management. Management of changes. Resource management of the project. Management of project cost. Quality management of the project. Computer technologies of project management. Computer modeling of implementation of the project on Business – the SimulTrain simulator.

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

On end of a course the student has to,

- Mobility: theoretical bases and conceptual framework of project management; main types and elements of projects; the major principles, functions and methods of management of projects; specifics of implementation of projects.
- to be able: to use the gained knowledge for development and project management; to develop the main documents of the project; to analyze and operate risks and changes of the project; to organize and control implementation of the project.

Protection of the graduate work (project)

THE CODE – ECA103

THE CREDIT – 6

PREREKVIZIT

PURPOSE AND PROBLEMS OF THE COURSE

The purpose of execution of the thesis / degree project (T/DP) is: systematization, fixing and expansion of the theoretical knowledge gained during training; profound studying by the bachelor of specific objectives and questions according to subject DR/DP; development in bachelors of skills of independent work at execution of the developed subject DR/DP; participation in production of division where execution of DR/DP is conducted; acquisition of experience of representation and public protection of results of the activity.

Achievement of the goal is carried out in the way:

- compliances of subject of DR/DP to the modern level of development of science and technology;
- realities of a subject and relevance of the developed questions;
- wide use by the bachelor of modern information technologies and products of the software on the selected subject;
- providing high scientific-theoretical and DR/DP practical level;

SHORT DESCRIPTION OF THE COURSE

Preparatory stage of execution of the thesis: choice of subject DR/DP. Drawing up task for execution of the thesis / degree project. Approval of a task of the releasing department and the statement of a subject. Thesis execution order: after approval of a task for DR/DP the head and the student bachelor make the planned schedule of work on a task. By drawing up the planned schedule the student should be guided by the fact that registration and execution of DR/DP should be finished by the beginning of a preliminary thesis defense.

The contents of the thesis should conform to requirements of qualification characteristic for the direction of training of bachelors for Telecommunications.

The thesis should contain: the summary in three languages; contents of the explanatory note; introduction; pre-project work – an analytical research of problems on subject DR/DP and development of the main solutions on their technical implementation; practical part; conclusion; the list of the used literature; applications (if it is necessary).

KNOWLEDGE, ABILITIES, SKILLS ON END OF THE COURSE

The thesis / the degree project – the final qualification work of the student intended for objective control of degree of formation of knowledge, skills in the field of radio engineering, electronics and telecommunications.

When performing DR/DP the student has to show the following abilities and knowledge:

- to independently set the research task, to estimate its relevance and the social importance;
- to collect and process information on subject DR/DP;
- to study and to critically analyse the existing materials on a work problem;
- deeply and comprehensively to investigate the revealed problem;
- to develop, describe and to professionally reason the versions of the solution of the considered problem;
- to formulate valid conclusions, offers, recommendations about implementation of the received results in practical activities.

Contents

1. Short description of a course	3
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2. The requirement for arriving	4
3. Requirements for completion of training and obtaining the diploma	7
4. Working curriculum of OP	9
5. Descriptors of level and volume of knowledge, abilities, skills and competences	12
6. Competences on completion of training	13
7. Policy of receiving additional education of Minor	14
8. ECTS Diploma Supplement	
9. Description of disciplines	16
10. Appendix A. Annex to the diploma in the ECTS standard	48
11. Appendix B. Reviews of employers of the educational program	53

Appendix A
STANDARD APPENDIX FORM TO THE DIPLOMA
European translation system and accumulation of points (ECTS)

 ҚАЗ ҰТЗУ	Kazakh National Research Technical University named after K.I. Satpayev Қ.И.Сәтбаев атындағы Қазақ Ұлттық техникалық университеті DIPLOMA SUPPLEMENT # _____
<p><i>This Diploma Supplement follows the model developed by the European Commission, the Council of Europe and UNESCO/CEPES. The purpose of this supplement is to provide sufficient independent data to improve the international 'transparency' and fair academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.) It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free of any value - judgments, equivalence statements or suggestions about recognition. Information should be provided in all eight sections. Where information is not provided, a reason should be given.</i></p>	
1	INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION
1.1	Family Name
1.2	Given Name
1.3	Date of Birth (Day/Month/Year) Republic Region, city (place of birth)
1.4	Student Identification Number
2.	INFORMATION IDENTIFYING QUALIFICATION
2.1	Title of Qualification and the Title Conferred Bachelor in Technics
2.2	Major
2.3	Minor
2.4	Name and Status of Awarding University in original language Қ.И.Сәтбаев атындағы Қазақ Ұлттық техникалық зерттеу университеті
2.5	Name and Status of Awarding University in English Kazakh National Research Technical University named after K.I. Satpayev
2.6	Language of Instruction
3	INFORMATION ON THE LEVEL OF THE QUALIFICATION
3.1	Level of Qualification Bachelor's level/ first-cycle degree of higher education
3.2	Official Length of Program 4 or 3 years

 ҚАЗ ҰТЗУ	Kazakh National Research Technical University named after K.I. Satpayev Қ.И.Сәтбаев атындағы Қазақ Ұлттық техникалық университеті
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3.1	Level of Qualification Bachelor's level/ first-cycle degree of higher education
3.2	Official Length of Program 4 or 3 years

3.3	Access Requirements																																													
4	INFORMATION ON THE CONTENTS AND RESULTS GAINED																																													
4.1	Mode of Study	Full-Time																																												
4.2	Program Requirements	129 credits of the Republic of Kazakhstan (240 ECTS credits), including General Studies – 30 (56 ECTS) credits, Basic Engineering Studies – 59 (110 ECTS) credits, Professional Studies – 40 (74 ECTS) credits, Elective Courses – 60 (112 ECTS) credits. Additionally, Practical Training – 6 (11 ECTS) credits, a Final Diploma Thesis – 3 (6 ECTS) credits																																												
4.3	Program Details	<i>Attached in transcript of records</i>																																												
4.4	Grading Scheme	<table border="1"> <thead> <tr> <th>Evaluation</th> <th>GPA</th> <th>Point %</th> <th>Appreciation</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>4</td> <td>95-100</td> <td>"Excellence"</td> </tr> <tr> <td>A-</td> <td>3,67</td> <td>90-94</td> <td>"Excellence"</td> </tr> <tr> <td>B+</td> <td>3,33</td> <td>85-89</td> <td>"Good"</td> </tr> <tr> <td>B</td> <td>3</td> <td>80-84</td> <td>"Good"</td> </tr> <tr> <td>B-</td> <td>2,67</td> <td>75-79</td> <td>"Good"</td> </tr> <tr> <td>C+</td> <td>2,33</td> <td>70-74</td> <td>"Pass"</td> </tr> <tr> <td>C</td> <td>2</td> <td>65-69</td> <td>"Pass"</td> </tr> <tr> <td>C-</td> <td>1,67</td> <td>60-64</td> <td>"Pass"</td> </tr> <tr> <td>D+</td> <td>1,33</td> <td>55-59</td> <td>"Pass"</td> </tr> <tr> <td>D</td> <td>1</td> <td>50-54</td> <td>"Pass"</td> </tr> </tbody> </table>	Evaluation	GPA	Point %	Appreciation	A	4	95-100	"Excellence"	A-	3,67	90-94	"Excellence"	B+	3,33	85-89	"Good"	B	3	80-84	"Good"	B-	2,67	75-79	"Good"	C+	2,33	70-74	"Pass"	C	2	65-69	"Pass"	C-	1,67	60-64	"Pass"	D+	1,33	55-59	"Pass"	D	1	50-54	"Pass"
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D+	1,33	55-59	"Pass"																																											
D	1	50-54	"Pass"																																											
4.5	Grading scale of the overall assessment (in original language)	Grade Point Average (GPA) 3.6 out of 4.0																																												
5	INFORMATION ON THE FUNCTION OF THE QUALIFICATION																																													
5.1	Access to Further Study	Eligible for second-cycle higher education, graduate programs in master																																												
5.2	Professional Status	<p>Under legislation of the Republic of Kazakhstan, a person who was taken Bachelor in Technics is qualified for posts or positions in the industrial, public and scientific sectors for which the qualification requirement is a first higher education degree in the major study. In some cases, the qualification requirement also includes the completion of studies in certain specified fields of minor study.</p> <p>The degree is also satisfied and corresponded to the Article 11 of the Directive of the European Parliament on the recognition of professional qualifications under level D of The European Union.</p>																																												
6	ADDITIONAL INFORMATION																																													
6.1	University Address	22 Satpayev Street, Almaty, 050013, Kazakhstan alint@ntu.kz www.kazntu.kz																																												
6.2	Further information source	http://edu.gov.kz/ru																																												
7	CERTIFICATION OF THE SUPPLEMENT																																													
7.1	Place and Date	" " 201 Almaty, Kazakhstan																																												
7.2	Rector	Beisembetov I./ Бейсембетов И.К.																																												

7.3	Official Stamp	
8 INFORMATION ON THE NATIONAL HIGHER EDUCATION SYSTEM		
<p>The education system of the Republic of Kazakhstan consists of basic secondary education, general upper secondary education, vocational upper secondary education, higher education and graduate education. The basic education consists of the 9-year compulsory school for all children from 6 to 15 years age.</p> <p>Post-compulsory education is given by the general upper secondary schools for 2 or 3 years and vocational upper-secondary institutions. The general upper secondary school provides 2- or 3-years, at the end of which pupils take the Unite National Test (UNT) examination for 2-year study and the Matriculation examination for the 3-year study. Vocational institutions provide 3-year programs, which lead to the upper secondary vocational qualifications with the further Complex Test Attestation (CTA).</p> <p>General eligibility for higher education is given by the UNT for the 4-year study, the Matriculation examination or the upper secondary vocational qualification with gained CTA results for 3-year higher education.</p> <p>Higher education studies are measured in credits. Study courses are qualified according to the workload required. One year of studies is equivalent to 1600 hours of student work on the average and is defined as 36 National credits or 60 ECTS credits. The credit system after recalculation complies fully with the European Credit Transfer and Accumulation System (ECTS).</p>		
8.1	University Degree	The Government Decree on University Degrees (GOSO/2016) defines the compulsory objectives, extent and overall structure of degrees. The universities decide on the detailed contents, curricula, forms of instruction and structure of the degrees awarded.
8.1.1	First-Cycle (Bachelor)	<p>The first-cycle university degree (Bachelor) consists of 99 (184 ECTS) credits for 3 years of full-time study or 129 (240 ECTS) credits for 4 years. The degree is called the Bachelor of Technology in all fields of study except Medicine and Architecture. The determined English translation for all the degrees corresponds to the Bachelor of Science in the European countries and the USA.</p> <p>Studies forwarding to the degree provide the student with: (1) functional knowledge of the fundamentals of the major and minor subjects or corresponding study entities or studies included in the degree program as well as the prerequisites for the following studies in the field; (2) functional knowledge and experimental skills needed for scientific thinking and the use of scientific methods for research needs; (3) functional knowledge and learning skills, needed for studies, leading to graduate university degrees and continuous learning; (4) professional skills and capacity for applying the acquired learning in the professional field work and beyond; (5) three-lingual language capacity (Kazakh / English / Russian) and communication skills.</p> <p>Studies forwarding to the degree include at least General Studies – 30 (56 ECTS) credits, Basic Engineering Studies – 59 (110 ECTS) credits, Professional Studies – 40 (74 ECTS) credits, Elective Courses – 60 (112 ECTS) credits. Additionally, Practical Training – 6 (11 ECTS) credits, a Final Diploma Thesis – 3 (6 ECTS) credits.</p>

8.2.1	Second-Cycle (Master)	<p>The second-cycle university degree (Master) consists at least 24 (45 ECTS) credits for 1-year full-time study, 36 (67 ECTS) credits for 1.5-years full-time study or 50 (93 ECTS) credits for 2-years full-time study. The degree is usually called Master of Technology or Master of Business Administration for 1 and 1.5-year full-time study; Master in Science for 2-years full-time study. The admission requirements for the second-cycle university degree (graduate) are a first-cycle university degree (undergraduate). General eligibility for the second-cycle education is given by a combination grade of the National Test of English Language unless an applicant has the certified IELTS test results with the overall scores - 6.0 and Proficiency Examination, which is corresponding to the GRE Subject Examination.</p> <p>Studies forwarding to the second-cycle university degree (Master) provide graduate with: (1) profound knowledge of the major subject or a corresponding entity and conversance with the fundamentals of the advanced studies in the field; (2) advanced knowledge and research skills needed to apply the scientific knowledge and research approaches required for the independent and demanding experimental work (dissertation); (3) good overall knowledge and professional skills in the major field needed for operating as an expert and developer in the field; (4) scientific knowledge and interests needed for the scientific (Doctoral) or postgraduate education devoted to cutting-edge science; (5) fluent professional English, communication and oral skills.</p> <p>Studies forwarding to the degree include at least Intermediate Studies – 8 (15 ECTS) credits and Advanced Studies – 16 (30 ECTS) credits. Additionally, Internship improving expertise – 6 (11 ECTS) credits, a Final Dissertation Work – 6 (11 ECTS) credits.</p>
8.2	Doctoral Degree (PhD in Science)	<p>Applicants can apply for the doctoral (Ph.D.) studies after the completion of a relevant second-cycle degree. General eligibility for Ph.D. education is given by a combination grade of the National Test of English Language unless an applicant has the certified IELTS test results with the overall scores - 6.0 and the Proficiency Examination, which is corresponding to the GRE Subject Examination, as well as at least the 3 year research experience in the relevant field. The aim of doctoral studies is to provide a student with in-depth and profound knowledge in their field of science through their scientific research and capabilities to produce novel scientific knowledge or solutions independently. The Doctor's degree takes minimum 3 years to complete. An applicant, who has been admitted to complete the Ph.D., Doctor's degree must take 12 (20 ECTS) credits of interdisciplinary study, show the independent and critical thinking in the field of research and write the Ph.D. dissertation to defend in public.</p>

10. Appendix B. Review of employers

