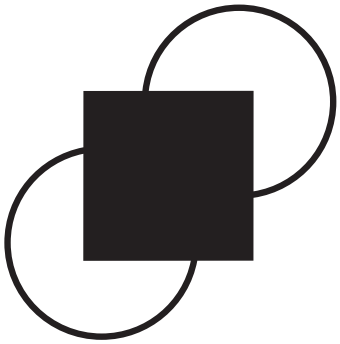
# iCERi 2016

## 9TH INTERNATIONAL CONFERENCE OF EDUCATION, RESEARCH AND INNOVATION


SEVILLE (SPAIN)
14-16 NOVEMBER 2016



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# CONFERENCE PROCEEDINGS

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# FEATURES OF FORMATION OF THE CURRICULUM ON A SPECIALTY "RADIO ENGINEERING, ELECTRONICS AND TELECOMMUNICATIONS"

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## Abstract

The Republic of Kazakhstan over the years of its independence has achieved a significant progress in reforming the higher education system. All activities regarding the reformation were designed to ensure that the state had the opportunity to prepare highly qualified and demanded specialists in all areas in accordance with the international standards. The official accession of the Republic of Kazakhstan to the Bologna process was held on the 11th of March in 2010. Thus, Kazakhstan became the 47th member-country of the Bologna process and the first Central Asian country that was recognized as a full member of the European education space. According to the obligations assumed on accession to the Bologna Declaration, Kazakhstan has to implement a number of activities until 2020. One of the most popular specialties among the other technical ones in Kazakhstan is "Radio engineering, electronics and telecommunications". But the problem is that nowhere in the world there is a specialty, with such a combination of fields: radio engineering, telecommunications, electronics. We carry out the analysis of working programs on a similar area of the world's leading universities on a regular basis, and work on the harmonization of the content of education in this area of training, which is one of the optional parameters of the Bologna process.

Keywords: Bologna process, curriculum, Radio engineering, electronics, telecommunications.

## 1 INTRODUCTION

In Budapest on the 11th of March during a meeting of the Bologna ministerial forum Kazakhstan joined to Bologna Process in 2010. The decision on accession of Kazakhstan was unanimously supported by representatives of 46 countries - signers of the Bologna declaration [1]. The event, which is historical for the Kazakhstan education system, means entry of the country into a zone of the European higher education. The made positive decision on accession of Kazakhstan to action of Bologna Process is an appreciation of the European academic circles of the reforms which are carried out by the country in the sphere of the higher education. Accession to Bologna Process provides to the Kazakhstan higher education institutions a number of advantages, such as recognition of the Kazakhstan qualifications and the academic steps, ensuring the academic mobility of students and teachers, re-offset of the credits of students of higher education institutions of Kazakhstan at foreign universities, convertibility of the Kazakhstan diplomas in Europe and expansion of opportunities of employment of graduates abroad.

Due to the high demand for specialists in the field of electronics and telecommunications systems 12 HIGHER EDUCATION INSTITUTIONS in our country is carried out by a set of specialty "radio engineering, electronics and telecommunications." It should be mentioned that in any university of the world there is no such specialty with such combination of the priority directions.

The profession of " Radio Engineering, Electronics and Telecommunications" carries out training of highly qualified specialists in the field of radio engineering, electronics and telecommunications of a new formation, having broad fundamental knowledge, initiative, possessing ability to adaptation at the changing requirements of the labor market and technologies able to work in team, having the knowledge and competences demanded, first of all, for work in the sphere of radio engineering, electronics and telecommunications.

The main purpose of the program is training expert with the high level of professional culture, having abilities to self-improvement and self-development, possessing set of the theoretical and practical skills established by a professional educational program of the direction of radio engineering, electronics and telecommunications; capable to carry out professional functions within one or more kinds of activity; understanding basic tendencies of development of the theory and practice in the field of radio engineering, electronics and telecommunications.


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## 2 COMPARATIVE ANALYSIS OF THE FORMATION CURRICULUM

Today, the development of telecommunication systems industry plays a huge role in the development of any country. Our state leads the uniform strategy directed on introduction of "clever economy" and introduction of high technologies that demands a high skill level of experts in this sphere. Leading universities of the world prepare graduates on such specialties as "Electronics and telecommunications", "Electrical Engineering and Electronics", "Electronic engineer".

Our task is to train specialists in the specialty "Radio Engineering, Electronics and Telecommunications", the competence of which meet international standards. The combination of three directions in one specialty is interfaced to some difficulties connected with the organization of the curriculum. For improvement the quality of education is carried out constant analysis of curricula of the similar directions of universities of Europe, America and Asia [2-5]. We will provide the comparative analysis of curricula on a bachelor degree in some universities.

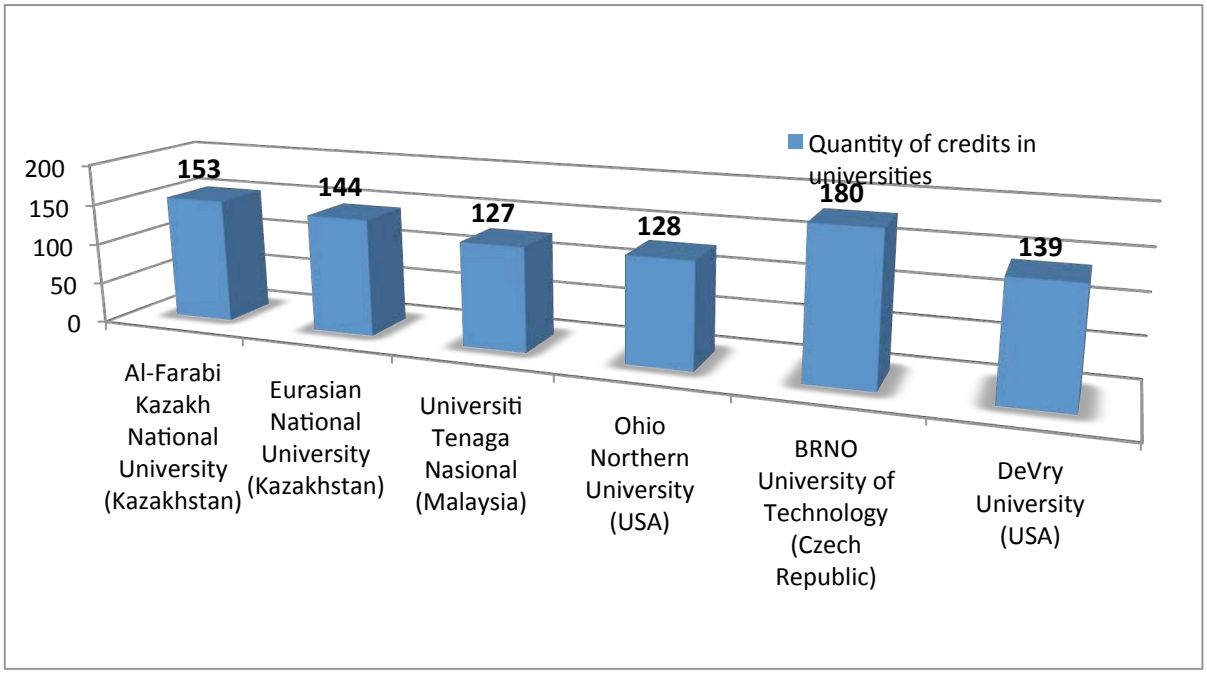


Fig. 1. Quantity of credits in universities.

As we see on the chart (Fig.1) quantity of the credits at the different universities of Asia, Europe and America preparing graduates on the specialties "Electronics and telecommunications", "Electrical Engineering and Electronics" varies. In compliance with state standard the quantity of the credits on this specialty shouldn't exceed 153. The curriculum as "a radio technician, an electronic engineer and a telecommunication" has to include the disciplines connected with analog and digital circuitry, the organization and operation of wireless networks, creation of telecommunication systems, satellite and radio relay data transmission, information security methods, a nanoelectronics and also general education module of disciplines, such as philosophy, sociology, political science, etc.

The analysis of curricula of foreign universities shows that the universities preparing graduates as "the radio technician and the electronic engineer" pay more attention to studying to circuitry of analog devices, digital processing of signals, the radio-transmitting devices, etc. Whereas at universities students of specialty "the electronic engineer and telecommunications" generally study telecommunication systems and networks, wireless technologies, microprocessor equipment, etc. Above-mentioned specialties are very close in respect of objects and spheres of studying. In this regard in Kazakhstan was opened the specialty "Radio Engineering Electronics and Telecommunications". The curriculum of this specialty was created as a result of the analysis of curricula of worldwide various universities, that preparing engineers in the field of telecommunication systems, the electronic engineer and the radio technician.

# 3 STRUCTURE OF THE CURRICULUM IN THE SPECIALTY "RADIO ENGINEERING, ELECTRONICS AND TELECOMMUNICATIONS"

In accordance with state educational standards of the Republic of Kazakhstan is made preparation graduates in the specialty "Radio Engineering Electronics and Telecommunications" on the basis of a three-level professional training system of specialists: bachelor, master and PhD (Fig 2).

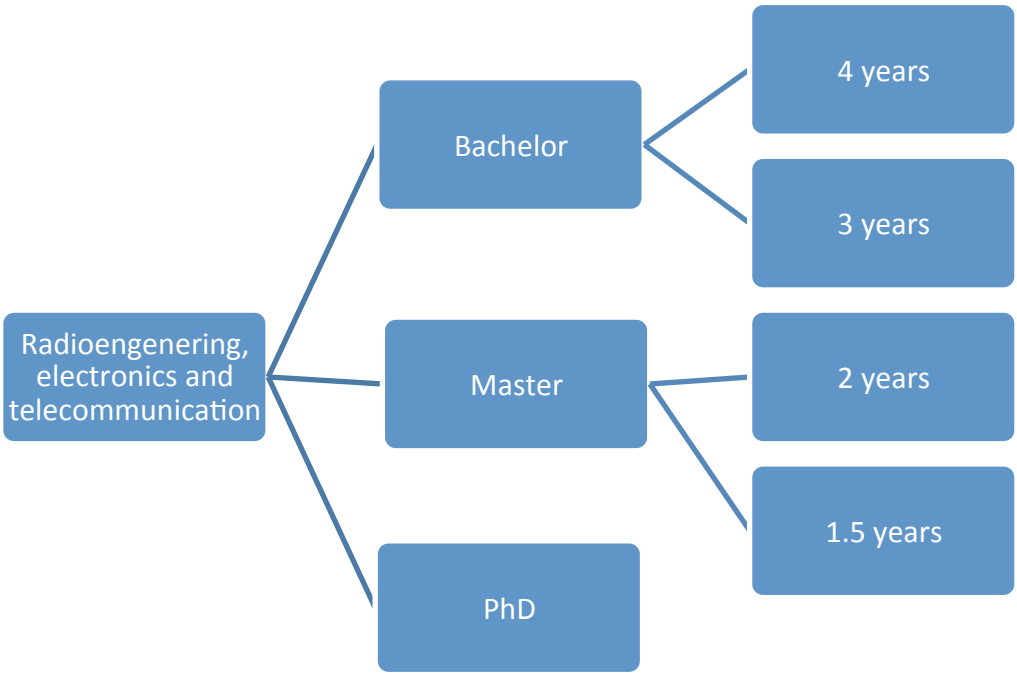


Fig 2. Structure of educational program of specialty “radio-engineering, electronics and telecommunication”.

## 3.1 Features of the organization bachelor degree’s curriculum

Applicants to the bachelor degree on a specialty "Radio Engineering, Electronics and Telecommunications" on a competitive basis, have to have a certificate about completion of 11 classes of secondary schools with the specialist subject – "physics". And the training period lasts 4 years. The total number of credits for all 4 years of training should be less than 153 credits. Table 1 shows the educational modules in this specialty at all levels of education. Applicants who have graduated from college with a degree in electronics and radio engineering are eligible to enter on the competition basis to this specialty with a term of 3 years of study.

Apparently from the table, the 4-year course of a bachelor degree has bigger quantity of the credits on such educational modules, as "state obligatory and social and communicative", including such disciplines as "history of Kazakhstan", "foreign language", etc., "natural-science" which includes such disciplines as "the mathematical analysis", "information and communication technologies", "radiophysics", etc., and also "the basic professional module". The basic professional module includes such disciplines as "physics", "mathematics", "bases of semiconductor electronics", "circuit design", " theory of electric circuit", "communication systems", etc. These courses are based on discipline that is maintained in the leading universities of Europe and America. These include universities such as – University of Cambridge, University of Toronto, Princeton University, University of Edinburg, etc. The practical block of the curriculum of four and three-year plans has no essential distinctions. In general, the accent becomes on development of practical actual knowledge.

## 3.2 Curriculum of a magistracy

The master's step is also subdivided into two directions (as it is seen from table 1.). Duration of training of the scientific direction of a step a magistracy – 2 years. The professional direction of a step the magistracy provides 1,5 summer training. The scientific direction of a magistracy, unlike professional, trains researchers and research associates. The professional direction focuses students on practical activities as the engineer in this specialty. The obligatory module of the scientific direction

contains such disciplines, as "history and philosophies of science", "pedagogics", "psychology" . The obligatory professional module consists of the following disciplines "modeling of telecommunication systems", "physical processes of a nanoelectronics and optoelectronics", "nonlinear processes in electronic systems", etc. The curriculum of the scientific direction, in compliance for the purpose of a course, contains bigger number of the credits in the theoretical block, and also in the modules of the practical block connected with research and experimental activity. Whereas the professional direction is focused on practical activities.

## 3.3 Organization of the curriculum of doctor's degree

Step duration of doctor's degree – 3 years (see table 1.). Training is minimized. All course is directed on the organization of scientific activity, focused on scientific seminars and work on the dissertation. The main module contains such disciplines as "technologies of nanodimensional semiconductors", "neural networks", "electric and optical properties of nanostructures", etc.

Table - 1.

| Type of education | Educational modules | Bachelor | | Master | | PhD |
|---|---|---|---|---|---|---|
| | | 4 years | 3 years | 2 years | 1.5 years | |
| Theoretical education | State Compulsory and Social and Communicative Module | 15 | 3 | 8 | 5 | |
| | Natural science module | 12 | 9 | | | |
| | BasicProfessionalModules | 72 | 68 | 14 | 8 | 3 |
| | Modules of individual educational trajectories | 27 | 27 | 20 | 23 | 12 |
| | Interdisciplinarymodule | 4 | 4 | | | |
| Practical education | Educational Practice | 2 | 0 | | | |
| | Pedagogical Practice | | | 3 | | 3 |
| | Practice training | 8 | 6 | | 4 | |
| | Research practice | | | 6 | | 2 |
| | Research seminar | | | 7 | 4 | 20 |
| | Pre-diploma practice or execution of dissertation | 2 | 1 | | | 30 |
| | Physical education | 8 | 0 | | | |
| | Diploma project or dissertation | 3 | 3 | 3 | 3 | 4 |

# 4 REQUIREMENTS TO RESULTS OF THE DEVELOPMENT PROGRAM.

The graduate of profession of radio engineering, electronics and telecommunications should be familiar with:

- bases of legal system and the legislation of the Republic of Kazakhstan, legal moral ethical standards in the sphere of professional activity;
- modern and perspective directions of development of telecommunication and information networks and systems, radar-tracking and radio navigational systems, computer technologies, modern software;
- the principles of work, technical characteristics and design features of the developed and used radio-electronic means, means of switching and communication;
- methods of carrying out theoretical and pilot studies in the field of technology of communication and electronics;

- methods of carrying out theoretical and pilot studies in the field of technology of communication and electronics;
- bases of design, construction, installation and operation of technical means of radio electronics, systems and communication lines, computer networks;
- requirements of standardization, metrological providing and health and safety during the developing and operation of radio-electronic devices and systems of telecommunication;
- technical and program and mathematical means of protection of information in telecommunication systems;
- the main methods of marketing and management in the field of telecommunications;
- rules and norms of design, construction, installation and operation of systems of radio electronics and communication lines, switching systems;

To be able:

- to carry out a choice of schemes of analog and digital electronic devices, to carry out circuitry calculations and to make schematic diagrams taking into account realization in integrated execution;
- to carry out development of devices of storage and display of information on the basis of program and hardware;
- to carry out a choice of the main types of microprocessors, the main stages and features of design, both separate subsystems, and all microprocessor system in general for various applications;
- to make scientific and technical documentation on the performed work;

To have skills:

- development and design on modern element base of the equipment and devices of systems of transfer, reception and distribution of information;
- to apply methods of the theory of telecommunications in the adjacent directions connected with information technologies;

## 5 GRADUATES OF SPECIALTY "RADIO ENGINEERING, ELECTRONICS AND TELECOMMUNICATIONS"

Every year in the specialty "Radio Engineering, Electronics and Telecommunications" in Kazakhstan, graduates 300 bachelor degree graduates. Graduates continue their education in this specialty in the country's universities and abroad, as well as they are in demand in the labor market and work in such a large organizations of communications, as JSC "Kazakhtelecom", JSC "Kazteleradio", "Astel", "ALSI" , "Logicom", "K-Cell", "Alkatel", JSC "Arna", K-mobile and others.

## 6 CONCLUSION

Combining areas of radio engineering, electronics and telecommunications allows to train specialists with a broader specialization. The curriculum of this specialty is based on plans of the leading universities in the field of "Electronics", "Electronics and Telecommunications" and "Radio Engineering and Electronics". Despite the lack of precedents for this specialty graduates are in demand in the labor market and is highly competitive. The challenge now is further integration of these areas, building more comprehensive and structured system of knowledge and skills required for a specialist in this area, based on the experience of foreign universities and their own experience. This system should be the most optimal aiming for good results, and include the best that modern technology can provide, the experience of teachers and of course eagerness and ambition of the student.

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