



საქართველოს ტექნიკური უნივერსიტეტი  
GEORGIAN TECHNICAL UNIVERSITY

Approved by  
GTU Academic Board  
Resolution # 733  
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April 2, 2018

## Doctorate Educational Program

### Name of the program

ტელეკომუნიკაცია

Telecommunication

### Faculty

ენერგეტიკა და ტელეკომუნიკაცია

Power Engineering and Telecommunication

### Head of the Program

Professor Janiko Khuntsaria

### Qualification to be awarded

Doctor of Engineering in Telecommunication

(ინჟინერიის დოქტორი ტელეკომუნიკაციაში)

*Shall be awarded in case of performing no less than 180 credits of the educational program*

### Language of Instruction

Georgian

### Prerequisite for admission to the program

Diploma certifying Master's or equivalent academic degree. The following shall be considered: existence of scientific publications; Participation in scientific conferences; Other documents and materials related to teaching/research activities (certificates, diplomas, patents, etc.).

Interview with Faculty Temporary Commission

## Description of the program

Doctoral Educational Program «Telecommunication» can be described as follows: The program capacity is 180 credits which is distributed the following way: Special subjects - 50 credits (27.8%); Scientific research and teaching methods - 10 credits (5,6%); Dissertation Research Project/Prospectus - 30 credits (16.7%); Theoretical/Experimental Research/Colloquium - 60 credits (33,3%); Completion and defense of the thesis - 30 credits (16,6%). In the first year of study covers: academic writing, scientific research and teaching methods, assistance of professor and special subjects (30 credits). In addition, during the same year the PhD student prepares Dissertation Research Projects/Prospectus (30 credits). The second year of study is dedicated to preparation and presentation of thematic seminars (30 credits) and preparation and defense of the colloquium related to the topic of the dissertation work (30 credits). At the end of the first semester of the third year, the PhD student presents Colloquium topic (30 credits), and in the second semester designs the dissertation thesis and defends it by the end of the semester (30 credits).

Evaluation of subjects and thematic seminars is made during the semester by using 3 forms (current activity, midterm exam and final exam). Evaluation of prospectus, colloquiums and doctoral thesis is made on the bases of the final exam. The assessments are made through the methods and criteria obtained at the Georgian Technical University. In particular, each form and component of the evaluation of the subjects has defined share in the final assessment from the total score (100 points). Also, minimum competence limit is defined in each form of assessment. Maximum score of current activity is 30 points (minimum positive assessment is 15 points), maximum score of midterm exam is 30 points (minimum positive assessment is 15 points), maximum score for final/extra exam is 40 points (minimum positive assessment is 20 points). As for the assessment of prospectus, colloquium and dissertation preparation and defense, it is made once in the session period and is assessed within frames of 100 points. In order to pass any component of the educational of the program, the student should accrue at least 51 points during the semester. In case the student has accrued 41 to 50 points in the program component during the semester, the program's relevant component is not passed and he is entitled to the right to pass an additional exam with independent work. In case of taking additional exam, the score received at the main exam is canceled. If the assessment does not exceed 40 points during the semester, the student has to retake the subject.

## The purpose of the program

Traditional telecommunication facilities (telephone, telegraph, data transmission, etc.) can not satisfy the existing requirements at the modern stage. The fact is confirmed by the process of development of the Internet and mobile network systems. Consequently, the World Telecommunication Community has proposed a new paradigm - the need to create the next generation networks (NGN), based on the use of packet switching, to provide transmission of different types of information with a single network infrastructure. Worldwide, telecommunication companies have been asked to solve the problem - how to integrate the existing telecommunication systems into NGN networks effectively, what kind of network architecture should be used, in what ways should the quality and safety of information transmission be ensured.

The creation and development activities of global information infrastructure take place in developed countries, envisaging to place the developing countries in world unified information space, guided by many international organizations, including the most authoritative - the International Telecommunication Union (ITU), that determined the main direction of scientific-theoretical and applied research in telecommunication field: Development of new methods of quantitative evaluation of qualitative indicators of functioning of modern networks and systems.

The aim of the Doctoral Program is to prepare specialists with the Doctor's academic degree, having systemic vision and deep knowledge of problems based on fundamental research, in order to conduct scientific research, project-construction, industrial-technological, organizational-managerial and educational activities, who have knowledge and skills to use research methods in the main directions of telecommunication field, know the modern trends of the field development and can identify complex problems and develop new ideas and methods for solving them.

#### **Learning outcomes / competences (general and sectoral)**

**Knowledge and understanding:** Has knowledge based on the latest scientific and technological achievements in the field of telecommunication, enabling him/her to use expanding knowledge or innovative methods at the standard level required for a refereed publication; Knowledge of international and national standards, methodical, normative and other guiding material relevant to professional and research activities; Knows research methods and determines the conditions for conducting research work; Uses mathematical apparatus related to scientific research and can define technical and economic efficiency of the obtained results.

**Ability to apply knowledge into practice:** Has the ability to: solve the problem independently based on the creative use of knowledge; Plan and implement innovative surveys independently and supervise them; Develop the latest research and analytical methods and approaches focused on gaining new knowledge and reflecting in international refereed publications; Construct imitational and mathematical models for the operation of telecommunication systems and networks; Analyse the prospects of development and condition of telecommunication techniques; Solve tasks of telecommunication systems and network construction reliability, service quality and economic growth and transparently formulate and identify priorities of the project objectives; Elaborate general options for problem solving, their analysis, prediction of results, and determination of compromise decision in multi-criteria conditions;

**Making judgments:** Has the ability to: make critical analysis, synthesis and assessment of new, complex and contradictory ideas and approaches in telecommunication field, thereby facilitate the elaboration/development of a new methodology; Make the right and effective decision independently to solve the problem; Make technical and economic justification of the decision made for further development of telecommunication networks and systems.

**Communication skills:** Has the ability to: demonstrate interconnection of new knowledge and accumulated knowledge in a clear and justified way, transmit difficult and controversial information to specialists and non-specialists considering their level of preparation; Use modern information and communication technologies creatively; Acquire new information technologies independently; Engage in the thematic polemics of the international scientific community in foreign language; participate in scientific-technical conferences and meetings.

**Learning skills:** Has the ability to: develop new ideas or processes while conduction learning and other activities (including research activity), based on the knowledge of the latest achievements. Has the ability to: plan and control the learning process of others; Organize research and technical knowledge enhancement activities; Contribute to the academic and professional fields of knowledge on the basis of wide implementation of scientific-research results; Use full range of teaching resources.

**Values:** Has the ability to: research the ways of establishing values and elaborate innovative methods for their establishment; evaluate his/her own and others attitudes towards values; Observe norms of professional values, ethics and moral, which is necessary condition to establish close contacts, have relation and achieve consent and unanimity with company executives, technical personnel, investment and commercial banks, business circles, municipal bodies, state structures and public representatives, international and local organizations, partners, etc.; Promote the creation of a global

information society; Forecast trends in telecommunication technologies and technology development and reflect them in educational programs and development plans of teaching-scientific base.

### Forms and methods of learning outcomes

Lecture     Seminar (team working)     Practice work     Laboratory  
 Scientific-thematic seminar     Independent work     Consultation  
 Research component     Dissertation design     Dissertation defense

Based on the specificity of the particular course, the appropriate activities of teaching-learning methods are used that are depicted in the course programs (syllabus):

#### Teaching Methods:

The most common methods of teaching and learning and their explanations. The teacher will select the required method depending on the specific goal and objective.

1. **Discussion / debate** - one of the most common methods of interactive teaching. Discussion process increases the quality and activity of student engagement. Discussions can be overcome in the debate and this process is not limited to the questions asked by the teacher. It develops a student's ability to reason and to justify his opinion.
2. **Case study** – The teacher discusses particular cases with students and they will learn the issue thoroughly. For example, in the field of engineering security it can be a particular accident or catastrophe in political science, for example, the analysis of the Karabakh problem (Armenian-Azerbaijani conflict), etc.
3. **Brain storming** - This activity promotes formation and expression of the radically different opinion, idea within the premises of the topic. The mentioned activity contributes to the development of a creative approach to the problem. Use of the method is effective in the existence of 2 large number groups of students and consists of several main stages:
  - Determining problem / issue in creative perspective; Making note without criticizing the ideas expressed by the listeners in a certain period of time (mainly on the board);
  - Determining assessment criteria to state the relevance of the idea with the aim of the research;
  - Assessing selected ideas according to the predetermined criteria;
  - Selecting the ideas that are most relevant to the issue, by the method of exclusion;
  - Identifying the idea having the highest assessment, as the best means revealing the solution of the problem.
4. **Demonstration Method** - This method involves visual representation of information. In terms of achieving the result it is quite effective. In many cases, it is best to provide the materials simultaneously with audio and visual means. The study material can be demonstrated by both - the teacher and the student. This method helps to visualize the different levels of learning material, to specify what students will have to do independently; at the same time, this strategy will visually represent the essence of the issue/problem. Demonstration may be simple.
5. **The deduction method** determines the form of transmission of any knowledge, which is a logical process of finding new knowledge based on general knowledge, i.e. the process is going from general to particular.
6. **Analysis Method** - Helps dissolve the learning material as part of one whole component. This will simplify detailed coverage of individual issues within a difficult problem.
7. **Synthesis** implies the creation of one whole by grouping separate issues. This activity contributes to the development of the ability to see the problem as a whole;
8. **Verbal or oral method** - Narration, speaking, etc. belong to this activity. In this process, the teacher represents the teaching material verbally, explains the teaching material, and the students perceive and acquire the material by listening, remembering and apprehending.
9. **Written work method**, which implies the following types of activities: making extracts and records, summarizing material, composing the theses, composing/writing abstract or essay etc.

10. **Explanatory method** – is based on the discussion around the given issue, a teacher gives particular example being discussed in details within framework of the topic.
11. **Action-oriented teaching** - requires the involvement of the teacher and the student in the teaching process, where the practical interpretation of the theoretical material is taken into consideration.
12. **Elaboration and presentation of the project** - While working on the project, the student uses acquired knowledge and skills to solve the real problem. The project enhances student motivation and responsibility. The work on the project involves planning, research, practical activity and the stages of presenting the results in accordance with the selected issue. The project is considered to be implemented if its results are presented in a clear and convincing way. It can be performed individually, in couples or in groups. At the same time the project can be made within the frames of one subject or several subjects (integration of the subjects); After completion, the project will be presented to a wide audience.

### Student knowledge assessment system

Assessment system is based on a 100-point scale.

Assessment of Teaching Component:

Positive grades:

- (A) - Excellent - the rating of 91-100 points;
- (B) – Very good - - the rating of 81-90 points
- (C) - Good - the rating of 71-80 points
- (D) - Satisfactory - the rating of 61-70 points
- (E) - Enough - the rating of 51-60 points

Negative grades:

- (FX) - Did not pass - 41-50 points of rating, which means that the student needs more work to pass the subject and is given the right to take the additional exam once with independent work;
- (F) – Failed - 40 points and less, which means that the work carried out by the student is not enough and he/she has to learn the subject from the beginning.

Assessment of Scientific-Research Component/Components:

- a) Excellent (summa cum laude) - excellent work
- b) Very good (magna cum laude) - the result is above all requirements;
- c) Good (cum laude) - the result exceeds the requirements;
- d) Average (bene) - the result meets all the requirements;
- e) Satisfactory (rite) - the result meets the requirements despite the shortcomings,
- f) Inadequate (insufficienter) - the result does not meet the set-out requirements due to significant shortcomings;
- g) Completely unsatisfactory (sub omni canone) - the result does not meet requirements.

### Field of employment

Scientific-research institutions, higher education institutions, colleges, design and construction departments of the companies and laboratories.

The objects of professional work are technical means, devices and transmission, processing, storage and information distribution systems based on digital and analog message networks and systems; Communication networks and switching systems; Multichannel telecommunication systems; Optical range telecommunication systems; Radio communications, satellite communication and mobile radio

communication systems and equipment; Radio and television broadcasting, electro acoustic and informatics, multimedia equipment systems and equipment; Data transmission systems and devices; Means of information protection in telecommunication systems; Telecommunication systems and networks for metrological support.

### **Human and material resources necessary for the implementation of the program**

The program is provided with appropriate human and material resources.

1. The research works will be conducted in the laboratories of the Telecommunication Department and in computer classes:

- Laboratory of IP Technologies (N513-A);
- Compact coding laboratory for telecommunication theory and telecommunication signals (N608);
- Transmission Systems Laboratory (N604);
- Radio System Recycling Laboratory (N612);
- Computer classes (NN504, 510, 610);
- Laboratory of Human Electromagnetic Safety and Electromagnetic Ecology (No. 913)

On the basis of the memorandums and agreements in the companies' facilities: JSC "Silknet"; Ltd. "Georgian TV and Radio Center"; Ltd. "Electromagnetic Compatibility and Interference Monitoring Service".

2. This program is served by highly qualified academic staff:

- Professor Nodar Ughrelidze;
- Professor Faik Bogdanov;
- Professor Jemal Beridze;
- Professor Tamaz Kupatadze;
- Professor Janiko Khuntsaria;
- Professor Otar Zumburidze;
- Professor Aleksandre Robitashvili;
- Professor Revaz Svanidze;
- Professor Lali Khuntsaria;
- Professor David Beriashvili;
- Professor Omar Shamanadze;
- Professor Sergo Shavgulidze;
- Professor Nanuli Gibradze.

For additional information on human and material resources see attached documents.

**Number of attached syllabuses: 5**

## Program subject load

Nº	Training component	Prerequisite for admission	ECTS credits						
			I Year		II Year		III Year		
			Semester						
			I	II	III	IV	V	VI	
1	Academic writing and scientific research methods	N/A	5						
2	Teaching methods	N/A	5						
3	Assistant of Professor	N/A		5					
4	Theory of digital communication	N/A	5						
5	Compact coding of telecommunication signals	N/A	5						
6	TV traffic Methods in Information Distribution Systems	N/A		5					
7	First thematic seminar	N/A			15				
8	The second thematic seminar	First thematic seminar				15			
Research component									
	Dissertation Research Project / Prospectus - 1	N/A	10						
	Dissertation Research Project / Prospectus - 2	Dissertation Research Project / Prospectus- 1		20					
	Theoretical / Experimental Research / Colloquium - 1	N/A			15				
	Theoretical / Experimental Research / Colloquium - 2	Theoretical / Experimental Research / Colloquium - 1				15			
	Theoretical / Experimental Research / Colloquium - 3	Theoretical / Experimental Research / Colloquium - 2					30		
	Completion of the dissertation thesis, defense	In case of 150 credits							30
<b>Total in year:</b>			<b>60</b>		<b>60</b>		<b>60</b>		
<b>Total:</b>			<b>180</b>						

## Map of learning outcomes

№	Training component	Knowledge and understanding	Ability to use knowledge in practice	Making judgments	communication skill	ability to learn	Values
1	Academic writing and scientific research methods	+	+	+		+	+
2	Teaching methods	+	+	+	+	+	+
3	Theory of digital communication	+	+	+	+	+	+
4	Compact coding of telecommunication signals	+	+	+	+		
5	TV traffic Methods in Information Distribution Systems	+	+			+	
6	First thematic seminar	+	+	+	+	+	+
7	The second thematic seminar	+	+	+	+	+	+
<b>Research component</b>							
	Dissertation Research Project / Prospectus - 1	+	+		+	+	
	Dissertation Research Project / Prospectus - 2	+	+		+	+	
	Theoretical / Experimental Research / Colloquium - 1	+	+	+	+	+	+
	Theoretical / Experimental Research / Colloquium - 2	+	+	+	+	+	+
	Theoretical / Experimental Research / Colloquium - 3	+	+	+	+	+	+
	Completion of the dissertation, protection	+	+	+	+	+	+



**Program curriculum**

№	Subject code	Training component	ESTS Credit / Hours	საათი						
				Lecture	Seminar (work in the group)	Practical work	Laboratory	Mid-semester exam	Final exam	Independent work
1	HEL10712G1-L	Academic writing and scientific research methods	5/125	15	30			2	2	78
2	EDU10912G1-L	Teaching methods	5/125	15	30			2	2	78
3	EET55602G1-LP	Theory of digital communication	5/125	15		30		1	1	78
4	EET55702G1-LS	Compact coding of telecommunication signals	5/125	15	30			1	1	78
5	EET55802G1-LSP	TV traffic Methods in Information Distribution Systems	5/125	15	15	15			1	78

Head of the program

Jemal Beridze

Head of Quality Assurance Service of  
Faculty of Power Engineering and Telecommunication

Nikoloz Abzianidze

Dean of the faculty

Gia Arabidze

**Approved by**

Faculty of Power Engineering and telecommunication  
At the Faculty Board Meeting  
03.07.2012.

Head of the Faculty Board

Gia Arabidze

**Agreed with**

Quality Assurance Service of GTU

Irma Inashvili

**Modified by**

Faculty of Power Engineering and telecommunication  
At the Faculty Board Meeting  
27.03.2018 (Protocol №2)

Head of the Faculty Board

Gia Arabidze