

The syllabus of the discipline  
*Information switching and distribution systems*

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Field name	Detailed content, comments
Name of the faculty	Faculty of Infocommunications
Level of higher education	First (bachelor's)
Code and name of the specialty	172 Telecommunications and radio engineering
Type and name of educational program	EPP "Information and Network Engineering"
Name of the discipline	Information switching and distribution systems
Number of ECTS credits	8
Discipline structure (distribution by types and hours of study)	48 hours - 24 lectures, 16 hours - 8 practical classes, 32 hours - 8 laboratory classes, 16 hours - 8 consultations, 128 hours - homework, <b>type of control: exam</b>
Schedule (terms) of studying the discipline	3rd year, VI semester; 4th year, VII semester
Prerequisites for studying the discipline	Basic knowledge of: 1. Data processing technologies in IC 2. Telecommunication theory 3. Fundamentals of information and communication technologies
Competences, knowledge, skills, understanding, which is acquired by the applicant in higher education in the learning process	The discipline is used to form the following competencies:  FC-3 Ability to use basic methods, methods and means of obtaining, transmitting, processing and storing information; FC-4 Ability to perform computer modeling of devices, systems and processes using universal application packages; FC-8 Willingness to promote the introduction of advanced technologies and standards; FC-9 Ability to accept and develop new equipment in accordance with current regulations; FC-10 Ability to carry out installation, adjustment, adjustment, adjustment, pilot testing, testing and commissioning of telecommunications facilities, means and equipment and willingness to promote the introduction of advanced technologies and standards for new generation technologies; FC-12 Ability to manage the flow of information and telecommunications networks, FC-15 Ability to perform calculations in the design of facilities and means of information and telecommunications networks, telecommunications and radio systems, in accordance with the terms of reference using both standard and self-created methods, techniques and software automation design.

The quality of the educational process	Educational-methodical and material-technical resource provision of the educational program, within the framework of which the discipline is studied, meets the licensing requirements and accreditation conditions of the educational activity of the university. Annual monitoring and revision of the curriculum of the discipline in accordance with the requirements and recommendations of the Ministry of Education and Science, state certification of acquired competencies of graduates, standards of cooperation with employers to ensure a competitive level of training. Adherence to the principles of academic integrity ( <a href="https://lib.nure.ua/plagiat">https://lib.nure.ua/plagiat</a> ). Contains public information on the requirements, competencies, level of education within the current educational program
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## Description and content of the discipline

The purpose of the discipline is to acquaint students with the basic methods of switching and distribution of information in telecommunications networks, principles of construction of switching systems, methods of calculating the characteristics of switching systems and methods of analysis and synthesis of switching fields and signaling methods.

### Content

#### Part 1

##### **Content module 1. Systems of switching and distribution of information in the modern telecommunications infrastructure**

Topic 1. Introduction. Basic concepts of information distribution systems.

Topic 2. Methods of switching in telecommunication networks.

Topic 3. Switching devices for spatial switching.

Topic 4. Construction of switching fields and switching nodes.

##### **Content module 2. Elements of the theory of teletraffic.**

Topic 5. Models of information distribution systems and service quality characteristics.

Topic 6. Call flows and loads.

Topic 7. Mathematical apparatus of analysis of information distribution systems.

Topic 8. Analysis of fully accessible information distribution systems that work for the discipline with losses.

Topic 9. Analysis of inaccessible switching circuits.

#### Part 2

##### **Content module 1. Principles of digital switching. Subscriber and line access and signaling subsystem.**

Topic 1. Principles of construction of digital TDM switching systems.

Topic 2. Modules of digital switching.

Topic 3. Methods of signaling in telephone networks.

Topic 4. ZKS-7 alarm system in modern telecommunication networks.

## **Content module 2. Construction of digital switching fields and bases alarm.**

Topic 5. Link switching systems and their analysis.

Topic 6. Construction of digital switching fields.

Topic 7. Digital PBX joints and load hubs.

Topic 8. Alarms in telephone networks.

## **Content module 3. CSC with circuit switching.**

Topic 9. EWSD switching system.

Topic 10. Switching systems SI2000 and SI3000.

## **Content module 4. Equipment for packet-switched networks.**

Topic 11. Analysis of information distribution systems that work on the discipline with expectations. Analysis of systems with priorities.

Topic 12. Technical implementation of packet switches.

Topic 13. General scheme and functions of the router IP-networks. Service planning algorithms.

Topic 14. Queue management algorithms and algorithms for profiling and smoothing traffic.

Topic 15. The main provisions of the next generation of NGN networks. PBX software. Asterisk.

## **Learning outcomes of higher education**

As a result of studying the discipline, students must:

- KNOW: basic principles of construction of switching systems; characteristics of switching devices; structures of switching systems, signaling and control methods.

- BE ABLE to: calculate the main characteristics of switching systems; to build switching fields from switching devices; use the methods of teletraffic theory to analyze information distribution systems.

- OWN: PRN1. Knowledge of theories and methods of basic and general engineering sciences to the extent necessary to solve specialized problems and practical problems in the field of professional activity; PRN3. Ability to apply knowledge in the field of informatics and modern information technologies, computer and microprocessor technology and programming, software for solving specialized problems and practical problems in the field of professional activity; PRN4. Ability to participate in the creation of application software for elements (modules, blocks, nodes) of telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems, etc.; PRN5. Ability to perform element calculations telecommunication systems, infocommunication and telecommunication networks, radio engineering systems and television and radio broadcasting systems, according to the technical task in accordance with international standards, using design automation means, incl. created independently; PRN7. Ability to participate in the design of new (modernization of existing) telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems, etc.; PRN8. Ability to apply modern achievements in the field of professional activity in order to build advanced telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems, etc.; PRN9. Ability to administer telecommunication systems, infocommunication and telecommunication networks; PRN10.

Ability to test telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems in accordance with technical regulations and other regulations.

### Assessment system according to each task for passing the test / exam

To assess the student's work during the semester, the final rating score Qsem is calculated as the sum of grades for different types of classes and grades for control activities. The maximum rating during the semester is 100 points.

#### Rating assessment by discipline (Part 1)

Type of lesson / control measure	Rating
Pr № 1	6-10
Test № 1	15-20
<i>Control point № 1</i>	21-30
Lb № 1	6-10
Lb № 2	6-10
Lb № 3	6-10
Pr № 2	6-10
Pr № 3	6-10
Test № 2	15-20
<i>Control point № 2</i>	45-70
Total for the semester	<b>60...100</b>

To evaluate the student's work during the semester, the final rating Qsem calculated as the sum of grades for different types of classes and tests measures. Each practical lesson is evaluated in 5 points (1 point for attendance and 4 points for work in the class). Each laboratory work is evaluated in 15 points (2 points for attendance, 3 points for practice, 10 points for defense). Home control work - 15 points, test - 10 points. The maximum rating during the semester is 100 points.

#### Rating assessment by discipline (Part 2)

Type of lesson / control measure	Rating
Pr № 1	3-5
Pr № 2	3-5
Lb № 1	6-10
Lb № 2	6-10
Lb № 3	6-10
<i>Control point № 1</i>	24-40
Lb № 4	6-10
Lb № 4	6-10
Pr № 3	3-5
Pr № 4	3-5
Pr № 5	3-5
Test	15-25
<i>Control point № 2</i>	36-60
Total for the semester	<b>60...100</b>

To evaluate the student's work during the semester, the final rating  $Q_{sem}$  calculated as the sum of grades for different types of classes and tests measures. The maximum rating during the semester is 100 points.

Criteria for assessing the knowledge and skills of the student in the combined exam.

The second part of the discipline (in the 7th semester) provides a combined exam.

$$Pp = 0.6 \times Q_{sem} + 0.4 \times Q_{isp},$$

where  $Q_{sem}$  - grade for the semester in a 100-point system,

$Q_{isp}$  - grade for the exam in a 100-point system.

The ticket for the exam consists of two theoretical questions and one task.

### Qualitative evaluation criteria in the national scale and ECTS

**Satisfactory, D, E (60-74).** Show the required minimum of theoretical knowledge. Know the ways and methods of solving practical problems and be able to use them in practice.

**Well, C (75-89).** Firmly know a minimum of theoretical knowledge. Demonstrate the ability to solve a practical problem and justify all stages of the proposed solution.

**Excellent, A, B (90-100).** Show complete knowledge of basic and additional theoretical material. Unmistakably solve a practical problem, explain and justify the chosen method of solution. Criteria for assessing the knowledge and skills of the student in the combined exam.

### Assessment scale: national and ECTS

The sum of points for all types of educational activities	ECTS assessment	Score on a national scale	
		for exam, course project (work), practice	for offset
90 – 100	<b>A</b>	perfectly	credited
82-89	<b>B</b>	fine	
74-81	<b>C</b>	satisfactorily	
64-73	<b>D</b>		
60-63	<b>E</b>		
35-59	<b>FX</b>	unsatisfactory with the possibility of reassembly	not credited with the possibility of re-assembly
0-34	<b>F</b>	unsatisfactory with mandatory re-examination	not credited with compulsory re-study of the discipline

## Methodical support

### Basic literature

1. Omelchenko A.V. Osnovy analizu system rozpodilu informatsii: Navch posibnyk. - Kharkiv: KhNURE, 2007. - 136 s.
2. Barkun M.A., Khodasevych O.R. Tsyfrovye systemy synkhronnoi kommutatsyy.-M.: Eko-Trendz, 2001.-188 s.
3. Avakov R.A., Shylov O.S., Ysaev V.Y. Osnovy avtomatycheskoi kommutatsyy.-M.: Radyo y sviaz,1981.-288 s.
4. Lyvshyts B.S., Pshenychnykov A.P., Kharkevych A.D. Teoryia teletrafyka. - M.: Sviaz. 1979. -224 s.
5. Holdshtein B.S. Systemy kommutatsyy.-SPb.:BKhV-Sankt-Peterburh, 2003.-318 s.
6. Yvanova O.N., Kopp M.F., Kokhanova Z.S., Metelskyi H.P. Avtomatycheskye systemy kommutatsyy.-M.: Sviaz, 1988.-264 s.
7. Bellamy Dzh. Tsyfrovaia telefoniya: per. s anhl. - M.: Radyo y sviaz, 1986.- 544 s.
8. Barkun M.A. Tsyfrovye avtomatycheskye stantsyy: Ucheb. posobyie dlia vuzov.- Mn.: Vysh. shk.,1990.-192 s.
9. Rosliakov A.V. Obshekanalnaia systema syhnyalzatsyy №7. – M.: Eko-Trenz, 2002.-176.
10. Semenov Yu.V. Proektyrovanye setei sviazy sleduiushcheho pokoleniia. – Spb.: Nauka y tekhnika, 2005. - 240 s.
11. Holdshtein A.B., Holdshtein B.S. SOFTSWITCH. – Spb.: BKhV –2006. – 368.
12. Kucheriavyi E.A. - Upravlenye trafykom y kachestvo obsluzhyvaniia v sety Ynternet. - SPb. Nauka y Tekhnika, 2004. - 336 s.

### Supporting literature

13. Olyfer V.H., Olyfer N.A. Kompiuternye sety. Pryntsypy, tekhnolohyy, protokoly. -S-Pb.: Yzd. Pyter,2000.-672 s.
14. Haivoronskaia H.S. Osnovy postroeniia setei y system telefonnoi kommutatsyy. – Odessa,1997. -105 s.
15. Dzhym Van Mehhelen, Laif Madsen, Dzharred Smyt. AsteriskTM: budushchee telefoniya, vtoree yzdaniye. – Per. S anhl. \_Spb: Symvol-Plius, 2009. – 656 s.
16. Kommutatory lokalnykh setei D-Link. Uchebnoe posobyie. M.: D-Link/. 2006. – 156.
17. Berlyn A.N. Kommutatsyia v systemakh y setiakh sviazy. – M.: Eko-Trendz, 2006. – 344 s.

### Methodical instructions for different classes

18. Komplekt slaid-lektsii z dystsypliny «Systemy komutatsii ta rozpodilu informatsii. Chastyna 1» dlia studentiv usikh form navchannia napriamu 6.050903 «Telekomunikatsii» [Elektronnyi dokument] / Uporiad.: A.V. Omelchenko. – Kharkiv: KhNURE, 2017. – 400 s.
19. Komplekt slaid-lektsii z dystsypliny «Systemy komutatsii ta rozpodilu informatsii. Chastyna 2» dlia studentiv usikh form navchannia napriamu 6.050903 «Telekomunikatsii» [Elektronnyi dokument] / Uporiad.: A.V. Omelchenko. – Kharkiv: KhNURE, 2017. – 400 s.
20. Metodychni vказivky do samostiinoi roboty z dystsypliny «Osnovy teorii rozpodilu informatsii» dlia studentiv usikh form navchannia spetsialnostei za napriamom 6.050901 – Telekomunikatsii [Elektronnyi dokument] / Uporiad. A.V. Omelchenko. – Kharkiv: KhNURE, 2017. – 36 s.

21. Metodychni vказivky do laboratornykh robit z kursu "Systemy komutatsii v elektrozv'iazku" dlia studentiv usikh form navchannia spetsialnostoni napriamku "Telekomunikatsii" /Uporiad.: A.V.Omelchenko ta in., Kharkiv, – KhNURE, 2006. – 99 s.

22. Metodychni vказivky do praktychnykh zaniat z dystsypliny "Systemy komutatsii v elektrozv'iazku" dlia studentiv usikh form navchannia spetsialnostoni napriamku "Telekomunikatsii" /Uporiad.: S.V.Omelchenko. – Kharkiv, KhNURE, 2008.- 74 s.

#### Information support

1. GNU Octave
2. MathWorks Matlab
3. Network Simulator (ns-2,3)
4. SMath Studio
5. PTC Mathcad