Syllabus
Course Program

MULTISERVICE TECHNOLOGY

Specialty
172 Electronic communications and radio engineering

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Network technologies and telecommunications

Department
Information systems named after V.O. Kravets (169)

Educational level
Master's degree

Course type
Free choice of specialized training

Semester
2

Language of teaching
English

Lecturers and course developers

Maksym Tolkachov

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Associate professor of NTU "KhPI", associate professor of the department "Information systems named after V. O. Kravets " NTU "KhPI". Work experience - 23 years. Author of more than 30 scientific and educational and methodological works. Leading lecturer in the disciplines: "Computer and telecommunication networks", "Design and administration of computer networks", "Technologies of transport networks", "System software of information communication systems"
Learn more about the teacher on the department's website

general information

Abstract

The discipline is focused on acquiring theoretical knowledge and practical skills in the design and operation of current telecommunication technologies and the smart use of current telecommunication technologies when calling multiservice telecommunications high-quality measures for ensuring the maintenance of various types of electrical services with a given level of service quality.

Purpose and goals disciplines

The goals and objectives of the educational discipline are the acquisition by learners of knowledge to solve the tasks of implementing multi-service networks, using various telecommunication technologies and taking into account the size of the network, bandwidth, type of network and communication channels between segments, load distribution, types of network protocols; under the leadership of a leading specialist, performing calculations of the necessary parameters and characteristics of multi-service networks in order to achieve the normative quality of service provision, using technical, scientific and reference literature, computer technology, knowledge of the principles of operation of multi-service network equipment, mathematical calculation methods; the ability to ensure the effective functioning of a multi-service network, as well as network operation planning with the analysis of information flows.

Format of classes

Lectures, laboratory work, independent work, consultations. The final control is an exam.

Competences

GC1. Ability to abstract thinking, analysis and synthesis.
GC3. Knowledge and understanding of the subject area and understanding of professional activity.
GC2. Ability to apply knowledge in practical situations.
SC1. Ability to apply scientific facts, concepts, theories, principles and methodologies of scientific research.
SC4. The ability to solve problems of ensuring reliability, survivability, immunity , information security and bandwidth of electronic communication and radio technical systems, taking into account economic, legal, security and other aspects.

Learning outcomes

LO 3 – to develop and implement modern and promising telecommunication and radio engineering systems, complexes, technologies, devices and their components
LO10 - to ensure reliability, survivability, immunity , information security and bandwidth of electronic communication and radio technical systems

Scope of the discipline

The total volume of the discipline is 1 2 0 hours. (4 credits ECTS): lectures – 32 hours, laboratory work – 16 hours, independent work – 72 hours.

Prerequisites for studying the discipline (prerequisites)

To successfully complete the course, you must have knowledge and practical skills in the following disciplines: "Telecommunications and information networks", "Theory of information and coding", "Security of information in vehicles".

Features of the discipline, methods and technologies of education

Lectures are conducted interactively using multimedia technologies. In practical classes, a project approach to learning is used, attention is focused on the application of information technologies. Study materials are available to students on the department's website

Program of educational discipline

Topics of lectures

Topic 1. Introduction. Ways of development of modern telecommunication networks.
Evolution of the concept of communication systems.
Model of multiservice networks.
Architecture of multiservice networks.
Topic 2. Concepts of the theory and practice of telecommunication networks
Principles of building multiservice networks
Dynamics of development of network technologies
The role of services in the development of network technologies
Topic 3. Evaluation of the efficiency of multiservice networks
General characteristics of multimedia traffic
Multimedia traffic quality of service parameters
Services of multi-service communication networks
Quality of telecommunication services
Topic 4. Real-time traffic transmission in multi-service networks
Real-time transport protocol
Description of the RTSR protocol
Real-time traffic transfer process
Topic 5. Technologies of access networks
General principles of building access networks
Convergence of networks
Trends in the development of access networks

City Ethernet networks
VSAT satellite radio access systems
Topic 6. Broadband access over analog telephone lines
xDSL broadband access technology
ADSL digital information transmission system
Topic 7. Optical access networks
Architecture and technologies of optical access networks
Passive optical networks (PON)
A-PON technology
Topic 8. Technologies of radio access networks
General characteristics of radio access networks
LTE broadband access networks
Organization of the physical level, channels and types of system information
Topic 9. Means of combining transport networks of different operators
Packet switching layer technologies
Routing in transport networks
Routing protocols of heterogeneous networks
External gateway protocols
Topic 10. Group broadcasting
Ways of organizing group broadcasting
IGMP protocol
Multicast routing protocols
Protocol of independent group broadcasting
Topic 11. Basic technologies of transport networks
General principles of building a transport network
Fiber optic transmission systems
SDH systems of the new generation - NGSDH
Ethernet backbone technologies
Topic 12. Strategies for ensuring the quality of service in transport networks
Quality of service in transport networks
Integrated Service Service (IntServ)
Differentiated service service (DiffServ)
Topic 13. MPLS technology
Multi-protocol switching using labels
MPLS IGP technology
MPLS TE technology
Technology of virtual networks
Convergence is the basis of the development of transport networks
Topic 14. Technology of programmable networks (SDN)
General principles of SDN construction
OpenFlow configuration and management protocol
Programmable switch operation
Topic 15. Management level technologies of multi-service networks
General principles of construction and history of development of telecommunications management systems
Softswitch concept
Topic 16. Administration of TCP/IP standard networks
Conceptual model of the network management system
Concept of network administration
Structure of Management Information (SMI)
SNMP protocol

Topics of practical classes

Not provided for in the curriculum

Topics of laboratory works

Topic 1. Discussion of requests for practical determination of the main indicators of multi-service networks
Topic 2. General methods of determining and ensuring parameters of the quality of service of user traffic in MSM
Topic 3. Comparative analysis of various technologies for building digital subscriber lines
Topic 4. Discussion of requests to transition access networks to passive optical network technologies
Topic 5. Comparative analysis of various technologies for building radio access networks
Topic 6. Discussion of the possibilities of transporting IR traffic over the SDH network. Study of NGSDH technology
Topic 7. Discussion of the possibilities of transporting IR traffic over the ATM network. Quality of service in transport networks
Topic 8. Requests for building a transport network based on backbone Ethenet technologies

Independent work

The course involves the implementation of an individual calculation task on the design of the transport network. The results of calculations are drawn up in the form of a written report. Applicants are also recommended additional materials (videos, articles) for independent study and analysis.

Literature and educational materials

Basic literature:

1. Trubchaninova K.A. Basics of information theory and coding: teaching . technical manual _ special University / S.I. Prikhodko, K.A. Trubchaninova , O.P. Bataev . - Kh.: UkrDAZT , 2017. - 110 p.
2. Digital transmission, switching and control systems: teaching . manual / Prykhodko S.I., Zhuchenko O.S., Severinov O.V., Usachov O.M.– Kh.: UkrDAZT , 2007. – 220 p. Electronic version.
3. Subscriber access networks: training . help _ for studies _ higher _ teach _ institutions / H.G. Bortnyk, V.M. Kychak , O.V. Stalchenko , V.F. Yablonskyi ; Vinnytsia . national _ technical _ Univ. – Vinnytsia: UNIVERSUM-Vinnytsia, 2009. – 201 p.
4. Manko O.O. High-speed means of optical and wireless communication: training . manual / O.O. Manko , V.V. Bondar, T.G. Bondarenko. - Kyiv: DUT, 2015. – 46 p.
5. Multi-channel communication and telecommunication technologies: textbook / Ed. V.V. Popovsky _ - Kh.: "Company SMIT", 2003. - 607 p.
6. Rozorinov G.M. High-speed fiber -optic communication lines: training . help _ 2nd ed., revision. and added _ / H.M. Rozorinov , D.O. Solovyov. - K.: Department, 2012. - 344 p.

Additional literature:

1. Recommendation ITU-T Series G. Systems and environments transmissions , digital systems and networks (2005).
WDM / P. M. Odnorog , S. V. Mykhaylenko, O. B. Omeshnska // Edited by V. B. Katok – K.: Velar , 2005. – 99 p.
2. Meshkovsky K.O. Synchronous digital networks of SCI. Technologies and structure of the WDM system: Study guide. / K.O. Meshkovskyi , V.G. Bondarenko, M.O. Bila, A.O. Chupenko , I.P. Pavelko - Kyiv: DUIKT, 2009 - 130 p.
3. Theory of information and encoding . Tutorial for training students in foreign languages majoring in Electronic Communications and Radio Engineering / K. Trubchaninova . O. Serkov, O. Kasilov. - Kharkiv : Tochka Publishing House , 2023. – 120 p.

Evaluation system

Criteria for evaluating student performance and distribution of points

100% of the final grade consists of the results of the assessment in the form of an exam (30%) and the current assessment (70%)
Control works 15
Laboratory works 30
Independent work, individual tasks 25

Rating scale

Total points	National rating	ECTS
90–100	Perfectly	A
82–89	Fine	B
75–81	Fine	C
64–74	Satisfactorily	D
60–63	Satisfactorily	E
35–59	Unsatisfactory (requires further study)	FX
1–34	Unsatisfactorily (re-study required)	F

Norms of academic ethics and policy of the course

The student must adhere to the "Code of Ethics of Academic Relations and Integrity of NTU "KhPI": show discipline, education, benevolence, honesty, responsibility. Conflict situations should be openly discussed in study groups with the teacher, and if it is impossible to resolve the conflict, it should be brought to the attention of the employees of the institute's directorate.
Regulatory and legal support for the implementation of the principles of academic integrity of NTU "KhPI" is posted on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Coordination

Syllabus agreed	02.06.2023	Head of Department Pavel PUSTOVOYTOV
	02.06.2023	Guarantor OP Oleksandr SERKOV