

The syllabus of the discipline

Modern software tools for modeling and optimizing communication networks

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| Field name | Detailed content, comments |
|---|--|
| Name of the faculty | Faculty of Infocommunications |
| Level of higher education | Second (master's) |
| Code and name of the specialty | 172 Telecommunications and radio engineering |
| Type and name of educational program | ESP "Information and Network Engineering" |
| Name of the discipline | Modern software tools for modeling and optimizing communication networks |
| Number of ECTS credits | 5 |
| Discipline structure (distribution by types and hours of study) | 20 hours - 10 lectures, 4 hours - 2 practical classes, 16 hours - 4 laboratory classes, 8 hours – 4 consultations, 102 hours - homework, type of control: exam |
| Schedule (terms) of studying the discipline | 1st year, first semester |
| Prerequisites for studying the discipline | Basic concepts of academic disciplines: Higher Mathematics; Telecommunication theory; Telecommunication and information networks |
| Competences, knowledge, skills, understanding, which is acquired by the applicant in higher education in the learning process | The academic discipline is used to form the following competencies: – be able to encode images and video data; choose the compression algorithm and encoding method according to the type of images in media stream. |
| 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 (https://lib.nure.ua/plagiat). Contains public information on the requirements, competencies, level of education within the current educational program. |

Description and content of the discipline

According to the qualification requirements for higher education in specialty 172 Telecommunications and Radio Engineering the purpose of the discipline is to provide students with knowledge, skills and abilities in the field of analysis, modeling and design of telecommunications and information networks.

Content

Content module 1.

Topic 1. Getting started with Omnet ++. Settings and the first project.

Topic 2. NED network description language.

Content module 2.

Topic 3. Construction of simple modules.

Topic 4. Messages and packages.

Content module 3.

Topic 5. Visualization of simulation results.

Topic 6. Configuring Omnet ++.

Learning outcomes of higher education

As a result of studying the discipline, students must:

KNOW: classification of models of telecommunication and information networks, general indicators of service quality, structures and structural properties of models

of networks for various purposes, methods of traffic service, principles of modeling and design of telecommunication and information networks.

BE ABLE: to develop mathematical, analytical and simulation models using the Omnet ++ software, to carry out technical substantiation of networks by studying the model, to use theoretical positions in their design.

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

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 control measures. Each practical lesson is evaluated in 5 points (2 points for attendance and 3 points for active participation in the lesson). Each laboratory work is evaluated in 10 points (2 points for attendance, 3 points for admission and testing, maximum 5 points for timely protection in the current laboratory work). Auditory test (ACR) - a maximum of 5 points, homework (SCR) - a maximum of 10 points. The maximum rating during the semester is $100 \times 0.6 = 60$ points. Admission to the combined exam sets a minimum of $60 \times 0.6 = 36$ points.

The maximum rating for the oral exam of the combined exam is $100 \times 0.4 = 40$ points.

| Type of lesson / control measure | Rating |
|----------------------------------|------------|
| Lb №1 | 10 |
| Lb №2 | 15 |
| DKR № 1 | 15 |
| Control Point № 1 | 40 |
| Lb №3 | 10 |
| DKR № 2 | 20 |
| Control Point № 2 | 30 |
| Lb №4 | 10 |
| DKR № 3 | 20 |
| Control Point № 3 | 30 |
| Total for the semester | 100 |

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.

Good, 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

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 | A | perfectly | credited |
| 82-89 | B | fine | |
| 74-81 | C | satisfactorily | |
| 64-73 | D | | |
| 60-63 | E | | |
| 35-59 | FX | unsatisfactory with the possibility of reassembly | not credited with the possibility of re-assembly |
| 0-34 | F | unsatisfactory with mandatory re-examination | not credited with compulsory re-study of the discipline |

Methodical support

Basic literature

1. Lozhkovsky AG Theory of queuing in telecommunications: textbook / A.G. Lozhkovsky. - Odessa: ONAS them. AS Popova, 2012. - 112 p.
2. Kleinok L. Theory of queuing: trans. with English / L. Kleinok; under ed. YOU. Neumann. - M.: Mashinostroenie, 1979. - 330p.
3. Taha Hamdi A. Introduction to Operations Research, 7th ed.: Per. with English – M.: Williams Publishing House, 2005. - 912 e. : ill. - Paral. tit. English
4. Thomas Chamberlain Learning OMNeT++: Pact Publishing, September 2013, 102 p.

Additional literature

1. Theory of communication networks / Ed. VN Roginsky. - M: Radio and communication, 1981.
2. Kleinrock L. Computing systems with queues. - M. Mir, 1979.
3. Curly EA Traffic management and quality of service on the Internet. - SPb. : Nauka i tehnika, 2004.
4. Lozhkovsky AG Calculation of single-channel systems with infinite queue at exponential service duration // Scientific works of ONAZ. O.S. Popova. - 2009. - № 2. - P. 10-13.
5. Lozhkovsky AG Comparative analysis of methods for calculating the characteristics of service quality in self-similar flows in the network // Modeling and information technology. Coll. Science. IPME Ave. GE Pukhov National Academy of Sciences of Ukraine. - Vip. 47. - K. : 2008. - P. 187-193.
6. Pustovoitov PE Analysis of multichannel computer networks with inhomogeneous priority input stream [Text] / L.G. Raskin, P.E. Pustovoitov, Sa'di Ahmad Abdelhamid Saeed Ahmad // Information and control systems in railway transport. - Kharkiv: HarDAZT, 2005. - 21,2.- P.45-49.
7. Pustovoitov PE Estimation of efficiency of multi-input computer networks by methods of phase aggregation of states [Text] / P.E. Pustovoitov, Sa'di Ahmad Abdelhamid Saeed Ahmad // Bulletin of the National Technical University "KhPI". - Kharkiv: NTU "KhPI", 2005. - №19. - P.101-104.
8. Pustovoitov PE Optimization of parameters of phase decomposition of high-dimensional Markov systems [Text] / O.B. Gray, P.E. Pustovoitov, Sa'di Ahmad Abdelhamid Saeed Ahmad // Open Information and Computer Integrated Technologies. - Kharkiv: NACU "KHAI", 2005. - №27. - P. 175-178.
9. Pustovoitov PE Application of the theory of Markov processes in the study of the efficiency of computer networks [Text] / P.E. Pustovoitov, Sa'di Ahmad Abdelhamid Saeed Ahmad // Mathematical Modeling. - Dniprodzerzhynsk: DSTU, 2005. - 21,2. P.100-102.
10. Pustovoitov PE Estimation of efficiency of semi-Markov computer networks of high dimension [Text] / L.G. Raskin, P.E. Pustovoitov, Sa'di Ahmad Abdelhamid Saeed Ahmad, El Saeed Abdelaal Elsaed Mohammed // Bulletin of the National Technical University "KhPI". - Kharkiv: NTU "KhPI", 2005. - № 56. - P.17-21.
11. P.E. Pustovoitov, Sa'di Ahmad Abdelhamid Saeed Ahmad, El Saeed Abdelaal Elsaed Mohammed // Bulletin of the National Technical University "KhPI". - Kharkiv: NTU "KhPI", 2005. - № 55. - P.167- 171.

12. Pustovoitov PE Estimation of efficiency of a computer network with a stream of group applications and unlimited turn [Text] / L.G. Raskin, P.E. Pustovoitov, El Saeed Abdelaal Elsaed Mohammed // Bulletin of the National Technical University "KhPI". - Kharkiv: NTU "KhPI", 2005. - № 59.– P.26-31.

13. Pustovoitov PE Estimation of efficiency of queuing system with Poisson incoming flow and non-Markov service [Text] / P.E. Pustovoitov // Bulletin of the National Technical University "KhPI". - Kharkiv: NTU "KhPI", 2006. - «19. - P.93-98.

Methodical instructions for different types of classes

1. Pustovoitov PE Modern software tools for optimization and modeling of infocommunication networks: nav. manual / P.Ye. Pustovoitov. - Kharkiv: KhNURE, 2019. - 116p. Approved Academic Council of KNURE March 29, 2019, Prot. №4 / 10.

<http://repository.kpi.kharkov.ua/handle/KhPI-Press/44524>

2. Metodichni vказivky do laboratornykh robit z dystsypliny «Prohramni zasoby modeliuvannia ta optymizatsii merezh zviazku» dlia studentiv usikh form navchannia spetsialnosti 172 Telekomunikatsii ta radiotekhnika [Elektronne vydannia] / Pustovoitov P.Ie. – Kharkiv: KhNURE, 2019. – 16 s.

3. Internet resource www.omnetpp.org/documentation

Computer software in the discipline

1. OMNeT ++ software package.