

FUNDAMENTALS OF COMPUTER NETWORKS

COURSE SYLLABUS

Code and name of specialty	121 Software Engineering	Institute	Faculty of Computer Science and Software Engineering
Program name	"Software Engineering"	Department	Software Engineering and Management Information Technologies
Type of program	Educational and Professional	Language of instruction	Ukrainian

LECTURER

Name and surname, email **Andrii Pashnev, *Andrey.Pashnev@khpi.edu.ua***



Ph.D. (Technical). Senior Researcher. Associate Professor at the Department of Software Engineering and Management Information Technology. Author (co-author) of more than 140 research papers and textbooks, 4 collective monographs, 20 textbooks, stamped by the university, 28 scientific articles, 51 research report and 2 utility model patents (h-index = 4, i10-index = 4 in Google Scholar – <https://scholar.google.com/citations?user=KcBe4YwAAAAJ&hl=ru>; ORCID ID is <https://orcid.org/0000-0002-9150-6108>).
Basic courses: " Fundamentals of computer networks " and " Project workshop ".

GENERAL DESCRIPTION OF THE COURSE

Summary	The course " Fundamentals of computer networks " is a course in the cycle of professional compulsory training in the specialty 121 "Software Engineering". It is taught in the third semester in the amount of 90 hours (3 ECTS credits), in particular: lectures –32 hours, laboratory classes – 32 hours, independent work –26 hours. There are no individual tasks. The study of the discipline ends with the test.
Course objectives	Providing students with basic knowledge about the principles of construction and operation of computer networks, the possibilities of traditional and advanced technologies of local and global networks, ways to create and manage such networks.
Types of classes and control	Lectures, laboratory classes, independent work. Current control - laboratory classes, intermediate modular control. The course ends with a final test.
Term	3

Student workload (credits) / Type of course	3 / Mandatory	Lectures (hours)	32	Workshops (hours)	32	Self-study (hours)	26
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Program competences

GC 05. Ability to learn and master modern knowledge.
GC 06. Ability to search, process and analyze information from various sources.
PC 22. Ability to accumulate, process and systematize professional knowledge on software creation and maintenance and recognition of the importance of lifelong learning.

Learning outcomes	Teaching and learning methods	Forms of assessment (continuous assessment CAS, final assessment FAS)
PLO 1. Analyze, purposefully search for and select the necessary information and reference resources and knowledge to solve professional problems, taking into account modern advances in science and technology.	Problem lectures, mini-lectures, work in small groups, presentations, laboratory classes (with elements of seminar discussion).	Written individual assignments for laboratory works (CAS), assessment of knowledge in laboratory classes (CAS), express surveys (CAS), online tests (CAS), final/semester control in the form of a semester test, according to the schedule of the educational process (FAS).
PLO 7. Know and apply in practice the fundamental concepts, paradigms and basic principles of operation of language, tools and computing software engineering.	Work in small groups, presentations, laboratory classes (with elements of seminar discussion), business and role-playing games, case method.	Written individual assignments for laboratory works (CAS), assessment of knowledge in laboratory classes (CAS), express surveys (CAS), online tests (CAS), final/semester control in the form of a semester test, according to the schedule of the educational process (FAS).
PLO 18. Know and be able to apply information technology for data processing, storage and transmission.	Problem lectures, mini-lectures, work in small groups, presentations, laboratory classes (with elements of seminar discussion), business and role-playing games.	Written individual assignments for laboratory works (CAS), assessment of knowledge in laboratory classes (CAS), express surveys (CAS), online tests (CAS), final/semester control in the form of a semester test, according to the schedule of the educational process (FAS).

ASSESSMENT AND GRADING

Ranges of points corresponding to grades	Total score (points) for all types of learning activities	ECTS grading scale	The national grading scale	Allocation of grade points
	90-100	A	excellent	
	82-89	B	good	
	74-81	C		
	64-73	D	satisfactory	
	60-63	E		
	35-59	FX	Unsatisfactory (with the exam retake option)	
	0-34	F	Unsatisfactory (with mandatory repetition of the course)	

100% Final assessment as a result of Final test (30%) and Continuous assessment (70%).
30% Final test.
70% Continuous assessment:
- 55% of assessment of tasks in laboratory classes;
- 15% intermediate control (the first modular control work - 5%, the second modular control work - 10%).

Course policy	Students must attend all classes according to the study schedule and adhere to the norms of academic ethics. To study the course, students need to have their personal computer and (or) use computers of the computer center at the department. Students must work with compulsory and recommended reading, including Internet resources. Students must complete and submit all laboratory works during the semester in which the course is taught, before the examination session. The final assessment is not carried out without the personal presence of students.
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COURSE STRUCTURE AND CONTENT

Topic 1	Basic terminology, classification and topological structures of computer networks	Laboratory work 1 (CN – Sprint01)	Modeling of topological structures of computer networks	Self-study	Analysis of software capabilities for modeling topological structures of computer networks
Topic 2	Passive computer network equipment and its characteristics	Laboratory work 2 (CN – Sprint02)	Calculation of attenuation in the communication line		Analysis of the dependence of the amount of linear attenuation on the type of passive equipment
Topic 3	Principles of construction of structured cable systems	Laboratory work 3 (CN – Sprint03)	Design of a structured cable system		Analysis of software capabilities for structured cabling systems design
Topic 4	Physical layer technologies of computer networks	Laboratory work 4 (CN – Sprint04)	Definition of data transmission standards in computer networks		Familiarization with the requirements of data transmission standards for the implementation of basic physical layer technologies in computer networks
Topic 5	Active equipment of local computer networks and principles of its work	Laboratory work 5 (CN – Sprint05)	Analysis of computer network adapter properties and Ethernet frame structure		Analysis of the capabilities of network traffic monitoring software
Topic 6	OSI model levels	Laboratory work 6 (Web Fullstack: Sprint 06, Sprint 09)	Analysis of the possibilities of software for simulating the functioning of computer network components		Familiarization with the software tools for simulating the functioning of computer network components
Topic 7	Addressing on computer networks that use the TCP/IP protocol stack	Laboratory work 7 (Web Fullstack: Sprint 06, Sprint 09. Track C: uchat)	Structuring a computer network using switches, studying the operation of STP and ARP protocols		Analysis of features of ARP and RARP protocols implementation on client and server part
Topic 8	Routing protocols in computer networks	Laboratory work 8 (Web Fullstack: Sprint 09)	Research the principles of the router. Modeling of static and dynamic routing algorithms		Analysis of differences in the implementation of routing algorithms in the RIP and OSPF protocols
Topic 9	TCP/IP protocol stack transport layer protocols	Laboratory work 9 (Web Fullstack: Sprint 06. Track C: uchat)	Performance analysis of TCP and UDP protocols		Analysis of the principles of TCP and UDP protocols that affect their performance
Topic 10	Network information services	Laboratory work 10 (Web Fullstack: Sprint 00, Sprint 06, Sprint 07, Sprint 09. Track C: uchat)	Analysis of TELNET and SNMP protocols		Analysis of factors influencing the security of TELNET and SNMP protocols
Topic 11	Security technologies in computer networks	Laboratory work 11 (Web Fullstack: Sprint 07. Track C: uchat)	Simulation of asymmetric data encryption algorithm		Analysis of differences in the implementation of symmetric and asymmetric data encryption algorithms

RECOMMENDED READING

1. Olifer, V., Olifer, N. (2020). Computer networks. Principles, technologies, protocols: Anniversary edition. Sanct Petersburg: Peter.
- 2 Fundamentals of local computer networks: A textbook. (2016). Sanct Petersburg: Lan Publishing House.
3. Andrew S. Tanenbaum, Nick Feamster, David Wetherall. (2020). Computer Networks. (6th ed). Pearson.
4. Doug Lowe. (2021). Networking All-in-One For Dummies. (8th ed.). John Wiley & Sons.
5. Tsarev, R. Yu., Nikityuk, L. A., Reznichenko P. I. (2013). Structured cable systems: textbook way for students of higher educational institutions. Odessa: ONAZ them. O.S. Popova.
6. James W. Kurose, Keith W. Ross. (2021). Computer Networking: A Top-Down Approach. (9th ed.). Pearson.
7. Adele Kuzmiakova. (2021). Computer Networks and Communications. Arcler Press.
8. Bilova, M. A., Evseev, S. P., Zhuchenko, A. S., Ivanchenko, I. C., Shmatko, A. V. (2019). Ethernet technology: laboratory workshop. Kharkiv: NTU "KhPI".

1. Gerry Howser. (2020). Computer Networks And The Internet: A Hands-On Approach. Springer.
2. IEEE Standard for Information Technology. (2020). Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks. Specific Requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. The Institute of Electrical and Electronics Engineers.
3. Crystal Panek. (2020). Networking Fundamentals. Sibex/John Wiley & Sons.
4. Polishchuk, V. V. (2019). Administration of computer networks and operating systems: methodical edition for students majoring in 121 "Software Engineering" of the Faculty of Information Technology of Uzhhorod National University. Uzhhorod.
5. Korolev, A. V., Kuchuk, G. A., Pashnev, A. A. (2003). Adaptive routing in corporate networks. Kharkiv: HVU.
6. Kuchuk, G. A., Gakhov, R. P., Pashnev, A. A. (2006). Information and telecommunication resource management. Moscow.: Fizmatlit.
7. Mahmoud Elkhodr, Qusay F. Hassan, Seyed Shahrestani. (2018). Networks of the Future: Architectures, Technologies, and Implementations. (1th ed.). Chapman and Hall/CRC.
8. Costin, V. M. (2018). Methods and means of protection of computer information: information security of computer networks: Textbook. Moscow: House of NITU "MISS".
9. Rudenkov, M. A., Proletarsky, A. V., Smirnova, E. V., Cruel, A. M. (2016). Technologies for information protection in computer networks. Moscow: National Open University "INTUIT".
10. Network Analysis Using Wireshark 2. Cookbook: Practical recipes to analyze and secure your network using Wireshark 2. (2nd ed.). Paperback.

INFORMATION RESOURCES ON THE INTERNET

1. Basics of local area networks. [Electronic resource]. Access mode. Retrieved from <https://intuit.ru/studies/courses/57/57/info>.
2. Computer networks. [Electronic resource]. Access mode. Retrieved from <https://www.lektorium.tv/course/22904#>.
3. Computer networks. [Electronic resource]. Access mode. Retrieved from <http://zvondozvон.ru/tehnologii/kompyuternye-seti>.
4. Protocols. [Electronic resource]. Access mode. Retrieved from <http://zvondozvон.ru/tehnologii/protokoli>.
5. Protocols and algorithms for routing in the Internet. [Electronic resource]. Access mode. Retrieved from <https://intuit.ru/studies/courses/1123/200/info>.
6. Web technologies. [Electronic resource]. Access mode. Retrieved from <https://intuit.ru/studies/courses/485/341/info>.
7. Network security. [Electronic resource]. Access mode. Retrieved from <https://intuit.ru/studies/courses/102/102/info>.
8. Simulation of network operation in net-simulator. [Electronic resource]. Access mode. Retrieved from <https://docplayer.com/34846131-Modelirovanie-raboty-seti-v-net-simulator-ustanovka-net-simulator.html>.
9. javaNetSim. [Electronic resource]. Access mode. Retrieved from <https://javanetsim.soft112.com>.

ACADEMIC INTEGRITY

Students are expected to adhere to the Code of Ethics of Academic Relations and Integrity of NTU “KhPI”.

The content of this syllabus is consistent with the course program.