



Computer Networks

Course description sheet

Basic information

Field of study Computer Science	Didactic cycle 2022/2023	
Major -	Course code WIINFS.li10.00436.22	
Organisational unit Faculty of Computer Science	Lecture languages Polish	
Study level First-cycle (engineer) programme	Mandatoriness Obligatory	
Form of study Full-time studies	Block General Modules	
Profile General academic	Course related to scientific research Yes	
Course coordinator	Krzysztof Zieliński	
Lecturer	Krzysztof Zieliński, Sławomir Zieliński, Łukasz Czekierda, Piotr Nawrocki, Bartosz Kwolek	
Period Semester 5	Method of verification of the learning outcomes Exam	Number of ECTS credits 4
	Activities and hours Lectures: 30 Laboratory classes: 30	

Course's learning outcomes

Code	Outcomes in terms of	Learning outcomes prescribed to a field of study	Methods of verification
Knowledge - Student knows and understands:			

Code	Outcomes in terms of	Learning outcomes prescribed to a field of study	Methods of verification
W1	Has detailed knowledge of computer and teleinformatic networks as well as elementary knowledge in the field of devices included in teleinformation networks	INF1A_W05	Examination
W2	He is familiar with the current state and the latest trends in the construction and management of computer networks.	INF1A_W03, INF1A_W05, INF1A_W06	Examination
Skills - Student can:			
U1	Is able to configure communication devices in local and large (wired and radio) ICT networks	INF1A_U08	Test
U2	He can configure a computer system for a specific application, taking into account the efficiency of its work and security	INF1A_U08	Execution of laboratory classes, Test
Social competences - Student is ready to:			
K1	Is able to properly prioritize when setting up a computer network and adequately plan work for yourself and other people.	INF1A_K04	Execution of laboratory classes

Program content ensuring the achievement of the learning outcomes prescribed to the module

The module enables obtaining knowledge in the field of computer and ICT networks as well as elementary knowledge in the field of network devices and their configuration.

Student workload

Activity form	Average amount of hours* needed to complete each activity form
Lectures	30
Laboratory classes	30
Preparation for classes	30
Realization of independently performed tasks	25
Contact hours	5
Student workload	Hours 120
Workload involving teacher	Hours 60

* hour means 45 minutes

Program content

No.	Program content	Course's learning outcomes	Activities
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No.	Program content	Course's learning outcomes	Activities
1.	<p># Introduction (2 hours) Basic issues related to communication in computer networks. OSI / ISO reference model - the construction principle and functions of individual layers. TCP / IP reference model. # Physical layer of the OSI model (2 hours) Transmission modes. Transmission media - wired and wireless. # Data link layer (2 hours) Tasks implemented by the data link layer. Protocols for access to the transmission medium. # Data link layer technologies (2 hours) Presentation of Ethernet, Token Ring, FDDI technologies. Frame construction, addressing, medium access protocols - CSMA / CD, token passing. # Rules for building an Ethernet network (2 hours) Topologies and typical configurations of modern networks. Fast Ethernet versions. # Data link layer devices (2 hours) Construction of network distributors. The algorithm and the construction protocol of the spanning tree. # Virtual LANs (VLAN) (2 hours) Types of virtual local networks. Rules for the construction of virtual local networks. # Network layer of the OSI model, principles of IP network addressing (2 hours) Network layer tasks. ARP, RARP, DHCP, ICMP, DNS protocols. The structure of IPv4 addresses. Methodology and techniques of address allocation. # Dynamic routing protocols (2 hours) The functionality of internal RIPv1, RIPv2, IGRP routing protocols. # Dynamic routing protocols - c.d. (2 hours.) OSPFv2 protocol functionality. BGP protocol functionality. # Transport layer of the OSI model (2 hours) Functions carried out by the transport layer. The functionality of TCP, UDP, SCTP protocols. # Introduction to advanced techniques used in modern IP networks (2 hours) Issues of the quality of data transmission in IP networks. Elements of data transmission security in IP networks. # Technologies of high-speed optical networks (2 hours) Rules for the construction of high-speed optical networks - WDM, DWDM. Switching techniques - OBS, OPS, IPoF. # ATM (asynchronous transfer mode) network (2 hours) Properties of the ATM network. Cooperation of ATM network with Ethernet network - LANE mechanism (LAN emulation). Cooperation of the ATM network with the IP layer using MPOA (multiprotocol over ATM).</p>	W1, W2	Lectures

No.	Program content	Course's learning outcomes	Activities
2.	<p># Introduction (2 hours) Configuration and rules of use of the laboratory. Rules for passing the laboratory. Discussion of the network configuration of the AGH University of Science and Technology. OSI model.</p> <p># The physical layer of the OSI model (2 hours) Properties of media used in the construction of computer networks. Independent execution and testing of UTP patch cable.</p> <p># Data link layer of OSI model (2 hours) Overview of the CSMA / CD protocol. Presentation of the principle of concentrator and switch devices operation.</p> <p># Virtual local networks (2 hours) VLAN network design. VLAN network configuration techniques.</p> <p># Construction report of the spanning tree (2 hours) The need to use the spanning tree protocol (STP). Configuration of STP protocol on switchboards and bridges.</p> <p># Colloquium (2 hours)</p> <p># Network layer of the OSI model (2 hours) Cooperation between the network layer and the data link layer. Properties of IP version 4, IP protocol and ARP protocol.</p> <p># Routing basics (2 hours) Introduction to static routing. Static configuration of routing tables.</p> <p># CIDR and VLSM techniques (2 hours) Designing the assignment of IP addresses version 4 using VLSM (variable length subnet mask). Configuration of static routing in complex network topologies using CIDR (classless inter-domain routing).</p> <p># Dynamic routing using the distance vector protocol (2 hours) Learning the basics of the protocols with distance vector. Configuration of RIP version 1 and 2.</p> <p># Dynamic routing using the link status protocol (2 hours) Properties and basics of the link state protocols. OSPF version 2 configuration.</p> <p># Colloquium (2 hours)</p> <p># Cooperation between dynamic routing protocols (2 hours) Administrative distance. Redistribution of route information.</p> <p># Laboratorium labowe (2 hours) Configuration of routing between virtual networks. The use of address translation techniques: NAT (network address translation) and PAT (protocol address translation).</p> <p># Colloquium (2 hours)</p>	U1, U2, K1	Laboratory classes

Extended information/Additional elements

Teaching methods and techniques :

Lectures

Activities	Methods of verification	Credit conditions
Lectures	Examination	
Lab. classes	Execution of laboratory classes, Test	

Method of determining the final grade

In order to obtain a positive final assessment, it is necessary to pass the problem laboratory and pass the exam. # The rating from the laboratory (marked L) is calculated as the weighted average of the tests in the form of oral, written, electronic (carried out using an e-learning platform) or practical. The weights of individual elements are determined by the laboratory leaders. # The final grade (marked as OK) is determined as the mean (mean S) of the laboratory grade (L) and the exam (E) according to the formula $S = 0.5L + 0.5E$ for $5.00 \geq S \geq 4.75$ OK = 5.0 (very good) for $4.75 > S \geq 4.25$ OK = 4.5 (+ db) for $4.25 > S \geq 3.75$ OK = 4.0 (db) for $3.75 > S \geq 3.25$ OK = 3.5 (+ dst) for $3.25 > S \geq 3.00$ OK = 3.0 (dst)

Prerequisites and additional requirements

Ability to write and convert numbers in hexadecimal, binary and decimal form, knowledge of English

Rules of participation in given classes, indicating whether student presence at the lecture is obligatory

Lectures: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z sylabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego. Laboratory classes: Studenci wykonują ćwiczenia laboratoryjne zgodnie z materiałami udostępnionymi przez prowadzącego. Student jest zobowiązany do przygotowania się w przedmiocie wykonywanego ćwiczenia, co może zostać zweryfikowane kolokwium w formie ustnej lub pisemnej. Zaliczenie zajęć odbywa się na podstawie zaprezentowania rozwiązania postawionego problemu. Zaliczenie modułu jest możliwe po zaliczeniu wszystkich zajęć laboratoryjnych.

Literature

Obligatory

1. Basic literature
2. # A.S. Tanenbaum, D.J. Wetherall, Computer Networks (issue V), Helion, 2012.
3. # K. R. Fall, W.R. Stevens, TCP / IP Illustrated, Volume 1: The Protocols (2nd Edition), Addison-Wesley, 2011
4. # B. Hartpence, Routing and switching. A practical guide, Helion 2013.
5. # A. Wolisz, The basics of local computer networks, volume I - Net equipment, WNT Warszawa 1990.
6. # K. Zieliński (ed.), Exercises to the computer network laboratory. AGH nr. 1581, Cracow 1999.
7. Supplementary literature
8. # IEEE 802 LAN / MAN standards - <http://www.ieee802.org>
9. # A. Józefiok, CCNA 200-125. Become the administrator of Cisco, Helion, 2018 computer networks
10. # RFC documents (<http://www.ietf.org>), including: RFC 791 (IP), RFC 826 (ARP), RFC 1058 (RIP), RFC 2453 (RIPv2), RFC 2131 (DHCP), RFC 1034 / RFC 1035 (DNS), RFC 2960 (SCTP), RFC 793 (TCP), RFC 768 (UDP), RFC 777 (ICMP), RFC2460 (IPv6)

Scientific research and publications

Publications

1. # Network Services in Context of Pervasive Mobile Internet, Krzysztof Zieliński. CEEMAS 2001: 15-28
2. # Network management services based on the openflow environment / Paweł Wilk, Piotr NAWROCKI // Computer Science ; ISSN 1508-2806. — 2014 vol. 15 no. 3, s. 253-270.
3. # Notification methods in wireless systems / Piotr NAWROCKI, Mikołaj Jakubowski, Tomasz Godzik // Computer Science ; ISSN 1508-2806. — 2016 vol. 17 iss. 4, s. 519-539.

Learning outcomes prescribed to a field of study

Code	Content
INF1A_K04	Potrafi odpowiednio określić priorytety służące realizacji określonego przez siebie lub innych zadania oraz adekwatnie zaplanować pracę.
INF1A_U08	Potrafi ocenić przydatność i korzystać z istniejących rozwiązań narzędziowych dla tworzenia ergonomicznych, efektywnych i bezpiecznych aplikacji, a także potrafi skonfigurować system komputerowy oraz urządzenia w sieciach teleinformatycznych dla konkretnego zastosowania z uwzględnieniem efektywności pracy oraz bezpieczeństwa
INF1A_W03	Ma szczegółową wiedzę w zakresie wybranych języków i technik programowania oraz uporządkowaną wiedzę w zakresie inżynierii oprogramowania, w tym projektowania i testowania systemów.
INF1A_W05	Ma szczegółową wiedzę w zakresie systemów operacyjnych oraz sieci komputerowych, z uwzględnieniem problematyki administracji i bezpieczeństwa.
INF1A_W06	Ma podstawową wiedzę dotyczącą zarządzania, w tym zarządzania jakością, i prowadzenia działalności gospodarczej