COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer networks [S1EiT1E>SK]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

dr hab. inż. Piotr Zwierzykowski prof. PP
piotr.zwierzykowski@put.poznan.pl

Lecturers

Prerequisites

The student starting the subject should have a basic knowledge of the construction and operation of computers and signal transmission. They should also be able to obtain information from indicated sources and be willing to cooperate as part of a team.

Course objective

To provide students with basic knowledge about the methods, technologies and protocols necessary to understand the operation of computer networks. Developing students" ability to analyze and detect anomalies in the operation of basic computer network protocols.

Course-related learning outcomes

Knowledge:
1. has basic knowledge of the operation of protocols ensuring network communication
2. has knowledge of issues of security of data transmission in computer networks
3. has knowledge of technologies that ensure communication in computer networksh

Skills:

1. is able to analyze the operation of protocols used in computer networks
2. can detect errors in the operation of protocols used in computer networks

Social competences:
The student understands that knowledge and skills regarding the protocols and technologies used in computer networks are constantly changing.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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The exam takes the form of a written and / or oral exam depending on the size of the group.
The exam consists of answers to at least 10 questions drawn individually by each student from a set of 45 issues known to students (passed on during the lecture). An urn with a number of tickets equal to the number of issues is used for the draw. After the draw, the fate is returned to the ballot box.
The answer to the question takes into account the extent of the answer and the depth of understanding of the issue by the student. Each answer to a given question is graded on a scale of 2 to 5. The final grade of the oral exam is the average of the scores for individual answers. The exam is passed when the average rating is higher than 2.75.

Programme content

The subject includes an overview of issues devoted to computer networks in the broadest sense. The issues covered include a broad spectrum of problems covering concepts, mechanisms and protocols used in modern computer networks.

Course topics

The topics of the lecture include the following issues:

1. Computer Networks and the Internet: m.in. Delay, Loss, and Throughput in Packet-Switched Networks, Throughput in Computer Networks, Encapsulation.

2. Application Layer: m.in. Processes Communicating, Transport Services Available to Applications, The Web and HTTP, Electronic Mail in the Internet, DNS–The Internet's Directory Service, Peer-to-Peer Applications.

3. Transport Layer: m.in. Relationship Between Transport and Network Layers, Multiplexing and Demultiplexing, Building a Reliable Data Transfer Protocol, Go-Back-N (GBN), Selective Repeat (SR), Connection-Oriented Transport: TCP, RTT, Reliable Data Transfer, Flow Control, TCP Congestion Control.

4. The Network Layer - Control Plane: Introduction, Routing protocols link state distance vector, Intra-AS routing in the Internet: OSPF ,Routing among the ISPs: BGP, The SDN control plane, ICMP: The Internet Control Message Protocol, Network management and SNMP.

5. The Network Layer - Data:Overview of Network layer data plane, control plane, a router, Internet Protocol (datagram format, fragmentation, IPv4 addressing), network address translation, IPv6, Generalized Forward and SDN (match, action), OpenFlow examples of match-plus-action in action.

6. The Network Layer - Data: IPv4/IPv6 addressing and subnetting.

7. The Link Layer and LAN: services, error detection, correction, multiple access protocols, LANs addressing (MAC), ARP, Ethernet, switches, VLANs, link virtualization (MPLS), data center networking.

8. Wireless and Mobile Networks: wireless links, characteristics (CDMA), IEEE 802.11 wireless LANs ("Wi-Fi"), cellular Internet Access: architecture, standards (e.g., 3G, LTE), principles: addressing and routing to mobile users Mobile IP, handling mobility in cellular networks, mobility and higher-layer protocols.

9. Security in Computer Networks: principles of cryptography, message integrity, authentication, securing e-mail, securing TCP connections: SSL, network layer security: IPsec, securing wireless LANs, operational

security: firewalls and IDS.

10. Multimedia Networking: m.in. multimedia networking applications, streaming stored video, voice-over-IP, protocols for real-time conversational applications, network support for multimedia.

The following issues are discussed during the laboratories:

1. The use of freeware tools for the analysis and testing of computer networks.

2. Analysis of the operation of application layer protocols on the example of HTTP and SSL.

3. Ensuring reliable communication - IP and TCP protocol.

4. Protocols supporting address management (DNS, NAT, ARP).

Teaching methods

Lecture: depending on the topic discussed and the students' interest, the lecture is conducted in one of three forms: traditional lecture, problem lecture or conversational lecture.

Laboratory exercises: exercises conducted by tutors in the laboratory of the computer networks laboratory. During the course, students learn about the basic tools for analyzing and testing computer networks (Wireshark). Then they use them to analyze the operation of basic network protocols, i.e. HTTP, DNS, TCP, UDP, IP, NAT, ICMP, ARP, DHCP and SSL.

Bibliography

Basic
James F. Kurose, Keith W. Ross: Computer Networking: A Top-Down Approach, 8/E, Pearson, June 2021

Additional
1. Douglas E. Comer: Computer Networks and Internets, 6/E, Pearson, 2016
2. Andrew S. Tanenbaum, David J. Wetherall: Computer Networks, 6/E, Pearson, March 2021

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	70	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00