COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer networks [S1MiKC1E>SK]

Course

Field of study
Microelectronics and Digital Communication

Year/Semester
1/2

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
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr inż. Janusz Kleban
janusz.kleban@put.poznan.pl

Lecturers

Prerequisites

The student starting this course should have a basic knowledge of the structure and operation of a computer and should know the binary and decimal number representation system. Should have the ability to convert decimal numbers to binary and vice versa, be able to obtain knowledge from indicated sources and be ready to cooperate as part of the team.

Course objective

Providing students with basic knowledge of computer networks necessary to further study more advanced issues. To familiarize students with selected concepts and network technologies, in particular with hardware solutions, the knowledge of which is necessary to properly build and configure computer networks. Developing students' skills in solving problems arising in the process of configuring network device parameters.

Course-related learning outcomes

Knowledge:
1. Has a systematic knowledge of components and protocols as well as the operation of IP networks.
2. Has knowledge of the use and configuration of network devices used in computer networks.

3. Has basic knowledge of network services and security.

Skills:
1. Is able to configure devices and run a local computer network.
2. Is able to configure routing and analyze packet exchange in a computer network.
3. Can correctly use concepts related to computer networks.

Social competences:
1. Is aware of the need for a professional approach to solving technical problems and taking responsibility for the technical solutions he proposes.
2. Understands the impact of own work on the team's results and the need to comply with the principles of teamwork and take responsibility for jointly performed tasks.
3. Knows the limitations of his own knowledge and skills, understands the need for further education.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: written exam in the form of a multiple-choice test, containing at least 70 questions covering the issues discussed during the lectures. Questions can be scored differently depending on the number of correct answers. Exam completion threshold: 51% of points (dst grade). The grading scale complies with the percentage division, i.e. from 61% of points - dst plus grade, 71% of points - db grade, etc. As a help in preparing for the exam, students receive a set of slides presented during lectures and a set of issues facilitating preparation for the exam.
Laboratory: on the basis of at least eight short (approx. 10 min.) tests, final test and reports. Passing threshold: 50% of the points obtained from all tests. It is also required to pass the reports from all exercises. The final test must be written by students who have not obtained enough points to pass the subject, or students who want to improve the proposed grade. Due to the fact that the tests are adapted to the current knowledge of students, it is not possible to correct the tests at later dates. In case of lack of a sufficient number of points, the final test allows obtain a pass. Students are required to complete all laboratory exercises. Passing is done by the teacher by checking the correctness of the exercise, e.g. by checking the correctness of network devices configuration and asking questions about the exercise being carried out. Failure to pass the exercise results in the necessity to repeat it on the date indicated by the teacher. Each student is required to upload a report on each exercise to the eKursy platform. Reports are subject to credit. Failure to pass even one report makes it impossible to obtain a credit for the course. Re-uploading the rejected report to the system, without making any corrections indicated by the teacher, will result in a reduction of the pool of points obtained by 3 points. Each report uploaded to the system after the date specified by the teacher will reduce the pool of points by 3 points.

Programme content

The course covers the following issues: structure and operation of routers, routing protocols, structure and operation of L2 and L3 switches, VLANs, WLANs, VPNs, SDN, MPLS protocol, NAT address translation, QoS in IP networks, WWW service, e-mail, basics of network security, Internet of the Future.

Course topics

Lecture:
1. Discussion of organizational issues related to the course: course program, rules for passing classes and literature. Components of the Internet. Addressing on the Internet. Route selection and flow control mechanisms in packet-switched networks.
2. Switching and routing. Construction and operation of packet network nodes. Carrier routers. Switching networks used in routers. Control algorithms for packet transmission in switching networks of carrier routers. Layer 3 switches.
3. Routing protocols. Static and dynamic routing. Classification of routing protocols. Characteristics of selected routing protocols.
4. Local networks. IEEE802 model. Local network topologies. Functional characteristics of the LLC and MAC layers. Operation of protocols used in the MAC layer. Addressing in local networks. ARP. Dynamic host configuration - DHCP protocol. Address translation - NAT.
5. Construction and operation of layer two switches. STP protocol. Link aggregation. VLANs. MPLS

protocol. WLAN networks.
6. VPN networks. Protocols used in VPN networks.
7. SDN networks. OpenFlow protocol. Control layer of SDN network. SDN network controller.
8. QoS in IP networks. DiffServ and IntServ. Supporting the operation of multimedia applications on the Internet.
9. Web service and HTTP protocol. E-mail operation, SMTP protocol. Basics of network management; SNMP and NetFlow protocol.
10. Network security. Types of attacks on the Internet. Ways to protect against attacks. Private and public key encryption. Firewalls. UTM devices. ACLs.
11. Prospects for the development of the Internet. Discussion of the assumptions of the Internet of the Future, with particular emphasis on the Internet of Things. Architecture of the Future Internet.
Laboratory:
1. IP addressing planning. FLSM and VLSM subnetting. Configuring routers in accordance with the prepared addressing for the laboratory network. Checking the correct operation of the proposed configuration.
2. Routing basics. RIPv2 and OSPF. Configuring routers, checking RIPv2 and OSPF parameters.
3 Static routing. Planning of addresses for a given network. Implementation of static routing on routers. Checking the correct operation of the network.
4. DHCP protocol. Configuration of protocol parameters.
5. Configuration of access control lists ACL.
6. Analysis of packets exchanged between the browser and the web server; and the operation of the following protocols: HTTP, DNS, TCP and UDP using Wireshark.
7. Functions of switches in LAN networks; creating a CAM table. VLAN configuration on switches. Configuration of the inter-VLAN routing.
8. Configuration of STP and RSTP protocol.
9. Repeating exercises that have not been passed.

Teaching methods

Lecture: conventional with the use of multimedia presentation available for students; additional examples are provided on the blackboard.
Laboratory exercises: the introduction to selected exercises is carried out by means of a multimedia presentation and examples provided on the blackboard. Each of the exercises has an instruction, according to which students carry out individual exercises. The instructions also contain additional questions related to the study topics.

Bibliography

Basic:
1. J. Kleban, Computer networks - slides for lectures.
2. J.F. Kurose, K.W. Ross: Sieci komputerowe. Ujęcie całościowe, Wydanie VII, Helion, Gliwice, 2017
3. A.S. Tannenbaum, D.J. Wetherall: Sieci komputerowe, Helion, Gliwice, 2012

Additional:
1. K. Nowicki, J. Woźniak: Sieci LAN, MAN i WAN - protokoły komunikacyjne, Wydawnictwo Fundacji Postępu Telekomunikacji, Kraków, 2001
2. Akademia sieci Cisco: Cisco Systems, INC.: autoryzowany podręcznik programu Cisco Networking Academy, red. Vito Amato; współpr. Wayne Lewis ; przekł. z jęz. ang. Wiesława Jachymczyk, Krzysztof Turczyński.

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00