COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer network devices [N1EiT1>USK]

Course

Field of study
Electronics and Telecommunications

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
20

Laboratory classes
0

Other (e.g. online)
0

Tutorials
20

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

A student taking this course should have a basic knowledge of computer networks, network protocols, and telecommunications networks. They should be able to use C/C++ programming languages. Additionally, they should have the ability to gather information from literature, standards, and other sources in Polish or English. They should be capable of integrating the obtained information, interpreting it, drawing conclusions, and justifying their opinions. Furthermore, they should be able to participate in team projects.

Course objective

The purpose of the course is to familiarize students with the functioning of computer network devices and the implementation of functions in the various layers of the TCP/IP and OSI RM models. As part of the course, students will learn about the construction of a router (including data switching, packet forwarding, and queuing), layer two switches, ADSL devices, EPON, GPON, XGPON, and NG2-PON2. They will also become familiar with access network standards. Additionally, students will gain experience in creating simple drivers for UNIX systems and learn about the design of network processors and FPGAs.

Course-related learning outcomes

Knowledge:

1. Possesses comprehensive knowledge of computer architecture.
2. Recognizes the hardware profiles of mobile devices and can identify their programming capabilities.
3. Has a foundational understanding of construction principles, standards, architecture, network protocols, and the operation of wide area and local area networks, with a particular focus on network devices.
4. Familiar with the principles of Linux driver development.
5. Familiar with the principles of implementing network devices using network processors and FPGAs.
Skills:
1. Capable of selecting the appropriate design of network devices based on technical requirements and operating conditions.
2. Competent in configuring network devices to perform basic network functions.
3. Able to match program capabilities with available hardware resources.
4. Proficient in writing and executing simple character drivers or network card drivers.
5. Capable of effective communication in Polish or English within professional and other environments.
Social competencies:
1. Demonstrates a sense of responsibility for designing electronic and telecommunications systems, understanding the potential dangers of their misuse to individuals and society. Familiar with principles related to information storage and access determination to ensure data security.
2. Acknowledges the impact of telecommunication and ICT systems and networks on shaping the environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge gained in the lecture is assessed through a written or oral exam. In the written format, students must answer 7-10 questions, which may include multiple-choice and open-ended questions with varying point values. The questions are divided into three or four scoring groups. In an oral exam, students randomly select one question from each group. For each question chosen, the student may also receive an additional related question. Evaluation of the responses considers the breadth of knowledge and depth of understanding demonstrated. Each exam consists of 50-60 prepared questions. To successfully pass the exam, students must earn a minimum of 50% of the possible points.

Skills acquired in exercises are assessed through a credit colloquium, which includes 7-10 test and open-ended questions with varying point values (ranging from 1 to 3 points based on difficulty) and class participation, where each participation can add or subtract 1 point. The passing threshold is set at 50% of the total points. Criteria for exam evaluation and passing are determined based on the number of points earned.
number of points grade
<=50 % 2,0
51% - 60% 3,0
61% - 70% 3,5
71% - 80% 4,0
81% - 90% 4,5
91% - 100% 5,0

Programme content

The course covers the structure of devices that implement the functions of individual layers of the OSI model. It includes a division and discussion of devices belonging to different network areas and domains (electrical and optical). The functioning of PON (Passive Optical Networks) is presented in detail. Issues related to programming network devices are also discussed.

Course topics

Lectures:
1. Devices and elements of computer networks in the OSI RM and TCP/IP model.
2. Construction of router switching functions and data queuing.
3. Router operation: routing table search functions, operating system, memory.
4. Overview of commercially available devices.
5. Construction and operation of data link layer switches.
6. Access networks: Construction and operation of ADSL and VDSL devices.

7. Power supply of network devices - POE standards.
8. Passive optical access networks: EPON, GPON, XG-PON, XGS-PON, NG2-PON.
9. Construction of OLT and ONU devices.
10. Development of network card drivers for Linux.
11. Overview of network processors. Building network processors based on EZChip processors.
12. Building network devices using FPGAs.
13. Programming network processors.

Tutorials:
1. Creating a character driver for Linux.
2. Creating a network card driver for Linux system.
3. Programming network processors: PING application, traceroute.
4. Network processor programming: Router functions.
5. Transmission scheduling in EPON networks.
6. Algorithms for searching data structures.
7. Creating data structures for xCAM memory.

Teaching methods

1. Lecture: Multimedia presentations illustrated by examples given on the blackboard.
2. Practical exercises: Performance of tasks given by the instructor - practical exercises to prepare the assumptions and how to solve the task, i.e., preparation of design assumptions on which implementation will be possible.

Bibliography

Basic
1. W. Kabaciński, Standaryzacja w sieciach ISDN, Wydawnictwo Politechniki Poznańskiej, 2001
2. W. Kabaciński, M. Żal: Sieci Telekomunikacyjne, WKŁ, 2008.
3. G. Danilewicz, W. Kabaciński: System sygnalizacji nr 7, WKŁ, 2005.

Additional
Asymmetrical Space-Conversion-Space SCS1 Strict-Sense and Wide-Sense Nonblocking Switching Fabrics
for Continuous Multislot Connections / Grzegorz Danilewicz (WEiT) // IEEE Access - 2019, vol. 7, s. 107058-107072
Supplement to “Asymmetrical Space-Conversion Space SCS1 Strict-Sense and Wide-Sense Nonblocking Switching Fabrics for Continuous Multislot Connections” - the SCS2 Switching Fabrics Case / Grzegorz Danilewicz (WEiT) // IEEE Access - 2019, vol. 7, s. 167577-167583

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	5,00
Classes requiring direct contact with the teacher	50	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	70	3,00