COURSE DESCRIPTION CARD - SYLLABUS

Course name
Network programming [S1Bioinf1>PSIEC]

Course

Field of study
Bioinformatics

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge: Student starting this module should have basic knowledge regarding computer systems organization, algorithms and data structures, and operating systems. Skills: He/she should have skills allowing formulation of algorithms and their programming with the use of at least one widely used software tool. He/she should have skills that are necessary to acquire information from given sources of information. Student should understand the need to extend his/her competences and should express cooperativeness in a team. Social competencies: In addition, in respect to the social skills the student should show attitudes as honesty, responsibility, perseverance, curiosity, creativity, manners, and respect for other people.

Course objective

1. Provide students" knowledge regarding computer networks, within the scope of using, configuration, design and programming of local area and wide area networks, and cognition of technical solutions applied in these networks. 2. Develop students" skills in solving simple problems related to the use and configuration of computer networks as well as network programming. 3. Develop students" skills in team work, especially in configuration, design, and programming of technical solutions applied in computer networks.

Course-related learning outcomes

Knowledge:
1. knows the selected topics considering networking technologies - [K1_W10]
2. has the basic knowledge dealing with life cycle of computing systems - [K1_W12]

Skills:
1. designs and creates computer software according to given specification, using appropriate methods, technics and tools - [K1_U07]
2. is able to prepare, in Polish or English, well documented report and oral presentation dealing with topics from the area of computer networks - [K1_U09]
3. is able to perform the funcionality analysis and requirements analysis of computing systems - [K1_U12]

Social competences:
1. understands the need of self-learning all the life and improving the competences - [K1_K01]
2. is able to cooperate and work in a team, accepting various roles - [K1_K02]
3. is able to define the priorities used for the implementation of the task defined by himself or others - [K1_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Formative assessment:
a) lectures:
based on answers to questions on previous lectures,
b) laboratory classes:
evaluation of doing correctly assigned tasks,

Total assessment:
a) In terms of lectures
- assessment of knowledge and skills in the form of test.
b) In the field of laboratories in the form of average grade based on:
- assessment of knowledge and skills acquired in the laboratory through a test
- implementation of a programming project

Programme content

The lecture should cover the following topics
1) Fundamentals of computer networks (historical note, motivation, required properties of a network, network architecture: OSI and TCP/IP, network topologies, network types, network devices, standards).
2) Lower layers of the ISO/OSI model and local networks (CSMA/CD - Ethernet, CSMA/CA - wireless networks).
3) Packet switching (switching and routing, route selection - route selection algorithms, RIP protocols and OSPF, Switching Equipment).
4) Basic communication protocols (structure, purpose, standards).
6) Basics of network programming (architecture, concepts)
7) Network program architecture
8) Examples of client programs and server programs
9) Possible approaches to the implementation of web applications

As part of laboratory, students will learn the following topics:
1) IPv4 addressing - basics,
2) advanced IPv4 addressing,
3) computer network architecture,
4) key and practical elements of the network layer model
6) network devices of Ethernet technology,
8) configuration of the Linux system to work in the IP network
9) static route selection in Linux / Cisco routers,
10) basic concepts of network programming
11) client-server architecture
12) the concept of a network sockets
13) programming using TCP and UDP protocols
14) technologies and problems of client implementation
15) technologies and problems of server implementation

Course topics

As part of the lecture component, students are introduced to the fundamentals of computer networks, beginning with a historical overview, motivation behind network development, and essential characteristics that modern networks must fulfill. The course covers network architecture models such as OSI and TCP/IP, network topologies, types of networks, and commonly used networking devices. Particular attention is given to the lower layers of the ISO/OSI model and to local area network technologies, including Ethernet (CSMA/CD) and wireless networks (CSMA/CA). Topics such as packet switching, routing principles, path selection algorithms, and routing protocols like RIP and OSPF are also addressed. Additionally, the course covers essential communication protocols, as well as an introduction to network programming—its core concepts, architectures, and the structure of client-server applications, along with different approaches to implementing network-based software.

The laboratory sessions are designed to provide hands-on experience and practical skills required to work with modern computer networks. Students explore key areas such as basic and advanced IPv4 addressing, network architecture, and essential aspects of the layered network model. They gain experience in configuring Ethernet-based networking devices and setting up Linux systems for IP networking. The labs also include practical exercises in static routing using Linux systems and Cisco routers. A significant portion of the lab work is devoted to network programming—covering core concepts such as client-server architecture, socket programming, and the use of TCP and UDP protocols. Students also engage with the technologies and challenges involved in implementing both client-side and server-side network applications.

Teaching methods

Lectures: multimedia presentation, presentation illustrated with examples presented on blackboard.
Labs: solving tasks, practical exercises with use of network devices, discussion, teamwork, multimedia showcase, programming project.

Bibliography

Basic
1. Unix - Network Services Programming. Networking APIs: Sockets and XTI, W.R. Stevens, Prentice-Hall 1998
2. TCP/IP Protocol Suite, 4th edition, B.A. Forouzan, McGraw-Hill Education, New York, 2009
3. Computer Networks, 5th edition, A.S. Tanenbaum, D.J. Wetherall, Pearson, Boston, 2011
4. Computer Networking: A Top-Down Approach, 7th edition, J.F. Kurose, K.W. Ross, Pearson Education, Boston, 2016
5. Computer Networks: A Systems Approach, L.L. Peterson, B.S. Davie, 5th edition, Morgan Kauffmann, San Francisco, 2012
Additional
1. Network Analysis and Troubleshooting, J. Scott Haugdahl, Addison-Wesley, 1999

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50