STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Computer networks		**1010331531010334959**

Field of study	Profile of study (general academic, practical)	Year /Semester
Information Engineering	**general academic**	**2 / 3**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**English**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours					No. of credits
Lecture: **45**	Classes: **-**	Laboratory: **30**	Project/seminars: **-**		**6**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
major	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**100 6%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student has basic knowledge of physics, especially in such fields as mechanics, thermodynamics, optics, electricity, magnetism, nuclear physics, solid-state physics, including knowledge essential to understand physical phenomena in electronic circuits. Student has organized knowledge with theoretical foundations of basic program constructions, algorithm implementations, paradigms and programming styles, software verification methods, formal languages, compilers, platforms.
2	**Skills**	K_U01: Student is able to acquire information from literature, data bases and other sources; student is able to integrate acquired information, to interpret it, to draw conclusions and to formulate and justify judgments. K_U03: Student is able to create engineer work documentation and to prepare text with the work result discussion.
3	**Social competencies**	K_K02: Student understands and is aware of the importance of nontechnical issues related to computer engineer activity. Student understands the responsibility associated to his engineering decisions. K_K07: Student understands the importance of stringent accomplishment of a given project with proper notation standards, proper language. Student understands the importance of keeping deadlines.

Assumptions and objectives of the course:

The main objective of the course is to provide knowledge on different computer networks technologies, including: transmission media, network hardware, methods and principles of communication, communication protocols in ISO/OSI layers. Additionally students have to obtain skills in making decisions on computer network design, installation and configuration.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student has organized knowledge with theoretical foundations of computer networks. - [K_W07]
2. Student has organized knowledge with theoretical foundations of Internet technologies. - [K_W11]
3. Student has organized knowledge with theoretical foundations of teleinformatics, protocols and services in telecommunication networks. - [K_W15]

Skills:

1. Student is able to work alone and in a group; student can assess time needed to finish a given work; student can develop and realize schedule necessary to keep up deadlines. - [K_U02]
2. Student is able to create engineer work documentation and to prepare text with the work result discussion. - [K_U03]
3. Student is able to do critical analysis of computer hardware operations, operating system and computer networks. - [K_U11]

Social competencies:

1. Student understands the responsibility associated to his own work. Student is able to subordinate to team work rules and to take responsibility for cooperative tasks. - [K_K04]
2. Student understands the importance of stringent accomplishment of a given project with proper notation standards, proper language. Student understands the importance of keeping deadlines. - [K_K07]

Assessment methods of study outcomes

Lecture: final exam.

Laboratory: tests before exercises, exercises assesment, reports assesment.

More than 50% points are necessary for positive result.

Course description

Lecture

Computer networks classification (LAN, MAN, WAN, wired, wireless). Communication models (point to point, broadcast, multicast, connection oriented, connectionless, peer to peer, client-server). Modes of transmission: synchronous, asynchronous, isochronous, narrowband, wideband. Topology. Media parameters and applications: twisted pair, coaxial, fiber, infrared, radio bands. Structured cabling. Multilayer transmission model. Physical and link layers. Communication channel access methods: CSMA/CA, CSMA/CD, token passing. Network hardware: network interface card, modem, hub, switch. Main technologies: Ethernet, ATM, IEEE 802.11. Last mile networks (ISDN, DSL, GSM, UMTS, CATV, PLC). Internetwork layer, IPv4, host addressing. Routers and switches. Routing algorithms and protocols. ICMP. IPv6. Transport layer, TCP (ports, sockets, circuit opening and closing). UDP.

Laboratory

Link layer. Transmission parameters analysis (delay, throughput) based on Ethernet and WAN networks. Internetwork layer. IP addresses management, routing table aggregation. Network and subnetwork addressing. Internetwork layer. Routing table optimization with distance-vector algorithms. Count to infinity problem and its solutions. Internetwork layer. Routing table optimization with Dijkstra algorithm. Transport layer. TCP analysis: throughput calculation, optimum window calculation, timeout calculation (Jacobsen algorithm). Transport layer. Throughput analysis with slow start and congestion avoidance algorithms, fast TCP implementations. Application layer. Network parameters analysis in IP telephony systems. Codecs, bandwidth calculation, header compression. Network configuration, basic network parameters analysis (ipconfig, netstat, ping, tracert, arp). Experiments with basic network protocols (Ethernet, IEEE 802.11, IP, TCP) with protocol monitoring program (Wireshark). Routing tables optimization for different network topologies (experiments with simulation tools). Application layer protocol analysis (HTTP, SIP). Fundamentals of network programming, TCP connection configuration. Communication protocol design and implementation.

Basic bibliography:

1. Computer Networks and Internets, D.E. Comer, 2001.
2. Computer Networks, A. Tanenbaum.
3. Data Communications and Transmission Principles: An Introduction A.J. Simmonds Palgrave Macmillan 1997

Additional bibliography:

1. Implementing Cisco IPv6 Networks by Regis Desmeules

Result of average student's workload

Activity	Time (working hours)
1. Lectures	45
2. Laboratory	30
3. Exam	2
4. Exam preparation	40
5. Theoretical preparation for laboratory	15
6. Practical preparation for laboratory	15
7. Laboratory reports	15
8. Consultations	3

Student's workload

Source of workload	hours	ECTS
Total workload	165	6
Contact hours	80	3

Practical activities	45	1