SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Electronics, Telecommunications and Information Technology
1.3	Department	Communications
1.4	Field of study	Electronics and Telecommunications Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Telecommunications Technologies and Systems/ Engineer
1.7	Form of education	Full time
1.8	Subject code	TST-E44.00

2. Data about the subject

2.1	Subject name					Internet Protocols					
2.2	Subject area					Electronics and Telecommunications Engineering					
2.3	Course responsible/lecturer					Professor Virgil DOBROTA, Ph.D					
2.4	Teachers in charge of applications					Assistant Professor Bogdan RUS, Ph.D					
2.5	Year of study	IV	2.6	Semester	1	2.7	Assessment	Exam	2.8	Subject category	DS/DOB

3. Estimated total time

Year/ Sem.	Subject name	No. of weeks	Course [hours/ week]	Applications [hours/ week]			Course [hours/ semester]	Applications [hours/ semester]			Indiv. study	TOTAL	Credits
				S	L	P		S	L	P			
IV/1	Internet Protocols	14	2		2		28		28		74	130	5

3.1	Number of hours per week	5	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the curriculum	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	28
Supplementary study in the library, online and in the field	10
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	30
Tutoring	3
Exams and tests	3
Other activities	

3.7	Total hours of individual study	74
3.8	Total hours per semester	130
3.9	Number of credit points	5

4. Pre-requisites (where appropriate)

4.1	Curriculum	N.A.
4.2	Competence	To know the principle of packet switching, the major Internet protocols according to TCP/IP architecture; basics of routing protocols

5. Requirements (where appropriate)

5.1	For the course	Cluj-Napoca
5.2	For the applications	Cluj-Napoca

6. Specific competences

Professional competences	C4. To design, implement and operate data, voice, video and multimedia services, based on the understanding and application of fundamental concepts from the field of communications and information transmission. C5. To select, install, configure and exploit fixed and mobile telecommunications equipment. To equip a site with common telecommunications networks.
Cross competences	N.A.

7. Discipline objectives (as results from the key competences gained)

7.1	General objectives	Developing the competences regarding the protocols used in Internet
7.2	Specific objectives	1. Developing skills and abilities to configure and to use TCP/IP-based networks (with IPv4, IPv6, Mobile IP, TCP, UDP, DHCP, DNS, ARP, ICMP, SSH, HTTP) 2. Developing skills and abilities to implement a stream-socket based client-server application in IPv4 and IPv6 networks

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction. TCP/IP Architecture. Types of Protocols. Network Layer Routed Protocols. IP Protocol: Header Format	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	IPv6 Protocol: Header Format		
3	IPv6 Protocol: Extension Headers, Types of Addresses		
4	IPv6 Protocol: Unicast, Anycast, Multicast Addresses		
5	IPv6 Protocol: Conclusions. Mobile IPv4 Protocol: definitions, principles. Mobile IPv6 Protocol: definitions, principles		
6	IP in IP Encapsulation. Transport Layer Protocols. TCP Protocol: Header Format		
7	UDP Protocol: Header Format. SCTP Protocol: Header Format. Client-Server Architectures		
8	TCP Connection Management. Application Layer Routing Protocols. Routing Protocols: Definitions		
9	Distance-Vector Based Routing Protocols: RIPv1, RIPv2, RIPng. Routing Loops Prevention		
10	Network Layer Routing Protocols. Link State Based Routing Protocols: OSPFv2, OSPFv3.		

11	Congestion Control. TCP Congestion Control. “Slow-Start” and Congestion Avoidance Algorithms		
12	Timers for TCP Congestion Control. Jacobson’s Algorithm. Karn’s Algorithm. Bakre-Badrinath’s and Balakrishnan’s Algorithms. Fast Retransmit and Fast Recovery Algorithms		
13	Future Internet. A Short History of Internet. Software Defined Networks SDN. OpenFlow Technology. Protocols for Future Internet		
14	Review. Examples of subjects given in the previous academic year		
8.2. Applications (lab)		Teaching methods	Notes
1	Organizing the laboratory teams. IPv4 Addresses	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, magnetic board
2	Linux/Windows-Based Commands for TCP/IP (IPv4): w, who, finger, ping, traceroute, tracert, telnet, ssh, putty, ftp		
3	Linux/Windows-Based Commands for TCP/IP (IPv6). Wireshark Packet Analyzer		
4	Configuration of Linux/Windows Workstations/Servers for IPv4/IPv6		
5	Socket Applications for Client-Server Architectures: Berkeley sockets. Mini-project subjects		
6	Working for mini-projects (step 1): Realize the IPv6 client: connected to IPv6 server without sending commands.		
7	Working for mini-projects (step 2): Finalize the IPv6 client: sending commands and receiving their results		
8	Working for mini-projects (step 3): Realize the IPv4 server: connections and commands from Windows client, returning the confirmation.		
9	Working for mini-projects (step 4): Integration of IPv6 client into IPv4 server.		
10	Defending the mini-projects		
11	Data Link and Network Layers ARP Protocol. Network Layer ICMP Protocol. Application Layer DHCP Protocol. Application Layer DNS Protocol		
12	Application Layer Routing Information Protocol RIP		
13	Experiments with RIPv1, RIPv2, RIPng using Packet Tracer		
14	Recovery Laboratory. Questions		

Bibliography

1. V. Dobrota, *Retele digitale in telecomunicatii. Volumul III: OSI si TCP/IP. Editia a II-a*, Editura Mediamira, Cluj-Napoca 2003
2. L. Peterson, B. Davie – *Computer Networks. A Systems Approach*. Fifth Edition. Morgan Kaufmann, 2012
3. A.S. Tanenbaum, D.J. Wetherall – *Computer Networks.* Fifth Edition, Prentice Hall 2010
4. P. Loshin, *IPv6 Clearly Explained*. Second Edition. Morgan Kaufmann, 2003
5. D.E. Comer, *Computer Networks and Internets with Internet Applications*. Sixth Edition, Prentice Hall, 2015

On-line references

1. V. Dobrota, *Internet Protocols*, Technical University of Cluj-Napoca, 2018. http://el.el.obs.utcluj.ro/pi/en_index.htm

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluations

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		The level of acquired theoretical knowledge and practical skills		Theoretical Test (mark T) : 9 questions		T, max 10 pts. 50%
Applications		The level of acquired abilities		Project (P1): oral and practical exam based on laboratory and project work Grid Test (P2): 9 questions with multiple choice answers		P1, max. 5 pts. 25% P2, max. 5 pts 25%
10.4 Minimum standard of performance						
$T \geq 5$ and $P=P1+P2 \geq 5$ and $(T+P)/2 \geq 4.5$						

Date of filling in
01.10.2018

Course responsible
Professor
Virgil DOBROTA, PhD

Teachers in charge of applications
Assistant Professor
Andrei Bogdan RUS, PhD