SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Master of Science
1.6	Program of study/Qualification	Artificial Intelligence and Vision
1.7	Form of education	Full time
1.8	Subject code	2.

2. Data about the subject

2.1	Subject name			***Computer Networks***			
2.2	Subject area			Protocols for Communication Networks			
2.2	Course responsible/lecturer			Prof.dr.ing. Vasile Dadarlat- Vasile.Dadarlat@cs.utcluj.ro			
2.3	Teachers in charge of seminars			Conf.dr.ing. Adrian Peculea- Adrian.Peculea@cs.utcluj.ro Conf.dr.ing. Iancu Bogdan- Bogdan.iancu@cs.utcluj.ro			
2.4 Year of study	I	2.5 Semester	1	2.6 Assessment	E–**e**xam, C–**c**olloq., V-**v**erif.		E
2.7 Subject category	Formative category: DA – advanced, DS – speciality, DC – complementary						DA
	Optionality: DI – imposed, DO – optional (alternative), DF – optional (free choice)						DI

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	1	3.3 Laborator		3.3 Proiect	
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	14	3.6 Laborator		3.6 Proiect	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	20
(b) Supplementary study in the library, online and in the field	10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	15
(d) Tutoring	11
(e) Exams and tests	2
(f) Other activities	

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Computer Networks – BSc level
4.2	Competence	Fundamentals of engineering and informatics

5. Requirements (where appropriate)

5.1	For the course	Video projector, attendance min. 50%
5.2	For the applications	Video projector, attendance 100%

6. Specific competences

Professional competences	**C1 -** Operation with mathematical methods and models, techniques and technologies specific to advanced engineering and informatics • **C1.1 -** Demonstration of advanced theoretical and practical concepts and principles related to communication and distributed systems • **C1.2 -** Use of specific theories and tools to explain the structure of complex communication and distributed systems • **C1.3 -** Use of models for different components of communication and complex distributed systems under partial specification conditions • **C1.4 -** Formal and comparative evaluation for the characteristics of the communication networks and complex distributed systems • **C1.5 -** Substantiation of the characteristics of complex communication and distribution systems, based on modern theoretical and practical trends **C2 -** Development of advanced techniques, methods and methodologies specific to communication networks and distributed systems • **C2.1 -** Recognition of techniques, methods, methodologies and advanced technologies used in digital communication systems, computer networks, mobile wireless systems, distributed computing • **C2.2 -** Setting the conditions of use for different computing platforms, communication servers, application servers, database servers, communication standards, programming environments • **C2.3 -** Development of applications based on new techniques, methods and methodologies for communication networks and distributed systems • **C2.4 -** Assessment of the need for technologies, resources, equipments and their integration and adaptation into complex systems **C2.5 -** Research, development and implementation of new, advanced techniques, methods and methodologies specific to communication networks and distributed systems
Cross competences	N/A

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

7.1	General objective	Preparing students and providing up-to-date information in the field of wide area networks, sensor networks, network security, Internet architecture. It aims to increase the capacity of analysis within the specific field, as well as to develop skills for design.
7.2	Specific objectives	Acquiring new theoretical knowledge specific to modern computer networks and security in computer networks New skills and abilities acquired: - Performance evaluation in high-speed networks, routing techniques in WANs, basic elements of network security (vulnerabilities, attacks, encryption, authentication), sensor network design elements - Configuration of MPLS routers, configuration of security equipment (virtual networks, firewall), elaboration of synthesis materials for specific subdomains

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
MPLS (MultiProtocol Label Switching): MPLS concept; MPLS terminology (labels, equivalent classes, nodes in the MPLS network domain, switched paths); assigning, distributing and	4	Oral, onsite or online exposures	

storing labels; protocols for signaling and distribution of labels; operations in the field of MPLS network		Presentation using slides, discussions (Q&A), consultations. The use of multimedia means, interactive teaching style, offering programs for self-testing, attraction in research contracts, consultations. Online tools used: MS Teams, Moodle, Skype.	
MPLS-VPN (virtual private networks based on MPLS): models of virtual private networks (overlay, peer); MPLS-VPN terminology (provider network, client network, routers, site, VRF table); MPLS-VPN model; packet transmission mechanism; the steps of defining/configuring a virtual private MPLS network.	4		
InfiniBand (Infinite Bandwidth): tcp/ip stack limitations in a data center; definition of the InfiniBand concept; architecture and components: links, channel adapters, switches, routers, management components; communication and I/O operations: queues, communication semantics, remote DMS; communication architecture; keys, virtual memory addressing, shared domains; virtual lines, QoS, multicast; management; comparison with other technologies (interfaces: PCI, PCI-X, interconnection technologies: Myrinet, Quadrics)	4		
Architectures for implementing elements of Quality of Service	2		
Architectures for implementing elements of security in computer networks; security fundamentals	4		
Gear for implementing security	2		
Private key encryption	2		
Public key encryption	2		
Authentication	2		
Specificity of security in wireless sensor networks	2		

Bibliography:

1. V.Dadarlat, E.Cebuc – Retele Locale de Calculatoare-de la cablare la interconectare, Ed. Albastra, 2006
2. W. Stallings – Data and Computer Communications, Prentice Hall, 2007
3. W. Stallings – Cryptography and Network Security, Prentice Hall, 2007
4. Peter Tomsu, Gerhard Wieser - MPLS Based VPNS: Designing Advanced Virtual Networks, Prentice Hall, 2001
5. Tom Shanley- InfiniBand Network Architecture, Addison-Wesley, 2002

8.2. Seminars	Number of hours	Teaching methods	Notes
MPLS signaling protocols: comparative analysis	1	Oral, onsite or online exposure Presentation using slides, discussions (Q&A), consultations. The use of multimedia means, interactive teaching style, offering programs for self-testing, attraction in research contracts, consultations. Online tools used: MS Teams, Moodle, Skype.	
MPLS based virtual private networks: design	1		
QoS implementation: test cases	1		
Algorithms for encription based on private key	2		
Standards for public key encription	2		

Bibliography:
1. V.Dadarlat, E.Cebuc – Retele Locale de Calculatoare-de la cablare la interconectare, Ed. Albastra, 2006
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3. W. Stallings – Cryptography and Network Security, Prentice Hall, 2007
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9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The content of the discipline was discussed with teachers in the field from our country (Politehnica Bucharest and Timisoara), but also abroad (France, Ireland, Finland), being evaluated and endorsed by ARACIS.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Ability to analyze specific problems The power of synthesis of information related to a specific subdomain	The exam consists of checking theoretical knowledge (questions) in writing (2 hours), plus the evaluation of a report (synthesis material) based on topics in the field.	70%
10.5 Seminars	Ability to solve specific problems	Colloquium based on written answers	30%
10.6 Minimum standard of performance: Solving design problems, elaborating synthesis studies for specific subdomains with a minimum of personal vision.			

Date of filling in:		**Title Surname Name**	**Signature**
	Lecturer	Prof.dr.eng. Dadarlat Vasile Teodor	
	Teachers in charge of application	Assoc.Prof.dr.eng. Peculea Adrian	
		Assoc.Prof.dr.eng. Iancu Bogdan	

Date of approval in the department 20.02.2024	Head of department Prof.dr.ing. Rodica Potolea
Date of approval in the faculty council 22.02.2024	Dean Prof.dr.ing. Mihaela Dinsoreanu