SYLLABUS

1. Data about the program of study

1.1	Institution	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	Master
1.6	Program of study/Qualification	Multimedia Technologies/ Telecommunications / Master
1.7	Form of education	Full-time
1.8	Subject code	TM-E16.40/ TC-E03.00

2. Data about the subject

2.1	Subject name					Wireless Systems					
2.2	Subject area					Electronics and Telecommunications Engineering					
2.3	Course responsible/lecturer					Professor Tudor PALADE, Ph.D.					
2.4	Teachers in charge of applications					Associate Professor Emanuel PUSCHITA, Ph.D.					
2.5	Year of study	II	2.6	Semester	3	2.7	Assessment	Exam	2.8	Subject category	DS/DO

3. Estimated total time

Year/ Sem.	Subject name	No. of weeks	Course	Applications			Course	Applications			Indiv. study	TOTAL	Credits
			[hours/ week]				[hours/ semester]						
				S	L	P		S	L	P			
II/3	Wireless Systems	14	2	0	1	0	28	0	14	0	58	100	4

3.1	Number of hours per week	3	3.2	of which, course	2	3.3	applications	1
3.4	Total hours in the curriculum	56	3.5	of which, course	28	3.6	applications	14

Individual study	Hours
Manual, lecture material and notes, bibliography	14
Supplementary study in the library, online and in the field	10
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
Tutoring	7
Exams and tests	3
Other activities	14

3.7	Total hours of individual study	58
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Microwaves, Radiocommunications, Cellular Radiocommunications
4.2	Competences	NO

5. Requirements (where appropriate)

5.1	Course	The Technical University of Cluj-Napoca (Video-projector, screen, whiteboard)
5.2	Applications	The Technical University of Cluj-Napoca (PCs with Internet access, video-projector, screen, dedicated software and hardware tools, QualNet licenses)

6. Specific competences

Professional competences	Theoretical knowledge (What do the student should know)	The students will know: – Basic concepts regarding microwave wireless transmission and reception – Transmission technologies for wireless networks – Radio propagation for LoS and nLoS fixed and nomadic links – Multiple access techniques for wireless networks – Broadband characteristics, architectures, functions, and services of WiFi, HIPERLAN/2, Bluetooth, WiMax, LMDS, MMDS networks – Cordless systems – Ad-hoc networks – Mobile agents in wireless networks
	Acquired skills (What the student is able to do)	The students will be able to: – Characterize basic wireless networks; – Understand the wireless channel behavior and compute the main radio link parameters; – Understand and assess the performance of various wireless access networks – Characterize various wireless technologies – Plan access system network scenarios – Analyze and plan wireless ad-hoc networks
	Acquired abilities (what equipment/ instruments/ softwares the student is able to handle)	The students will be able to: – Use professional simulators for wireless systems and plan various network architectures – Comprehend the features of the main technologies for remote system configuration – Use the spectrum and network analyzers – Use the signal synthesizer and vector signal analyzer to measure the parameters of various radio network technologies
Transversal competences		Adapting to new technologies, professional and personal development through continuing education using electronic documentation and printed sources, in Romanian and in at least one international language (English). Competencies for analysis and synthesis and system optimization thinking. Flexibility in thinking and ability to work with interdisciplinary concepts and tools.

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

7.1	General objective	Developing the competences regarding the use, analysis and (re)design of fundamental electronic circuits.
7.2	Specific objectives	1. To apply the theoretical concepts of radio network planning while using professional software tools for design, test and measurements (QualNet, AirMagnet Laptop Analyzer). 2. To develop skills and abilities to plan, implement, test and evaluate the radio networks.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Fundamentals of radio transmission and reception	Presentation, exemplification, problem presentation, case study, discussions	Use of .ppt presentation, video-projector, whiteboard
2	The wireless communications network		
3	Propagation characteristics of the radio channel.		
4	The wireless transmisssion – multiplexing, spread spectrum, coding, errors, etc.		
5	Medium access control		
6	WiFi access networks		
7	Characteristics and services of the HIPERLAN2 standard		
8	Bluetooth networks		
9	LMDS and MMDS networks		
10	WiMAX radio access technology		
11	Cordless systems		
12	Ad-hoc networks		
13	Mobile agents in wireless networks		
14	WAP		
8.2. Applications (laboratory work)		Teaching methods	Notes
1	Introduction to mobile wireless system simulation using GloMoSim	Didactic and experimental proof, didactic exercise, simulations, team work	Use of laboratory instrumentation, wireless network simulators, computers
2	The influence of the propagation and fading models on the performance of wireless communication systems		
3	The effect of the multiple access techniques on the communication performance. The hidden terminal and exposed terminal problems.		
4	Performance analysis of routing protocols in wireless ad-hoc systems.		
5	Evaluation of the Access Point capacity in a wireless system.		
6	The influence of mobility on the performance of wireless systems		
7	Evaluation of a wired-wireless scenario		
8	The effect of the multiple access techniques on the communication performance. Quality of service support.		
9	The effect of upper layers on the performance of wireless systems.		
10	Routing protocol evaluation using NS-2		
11	The analysis of an 802.16 network using LabView		
12	Matlab simulation of radio channel fading		
13	Access network scenarios in OPNET		
14	Performance analysis of wireless networks in the 5GHz frequency band using Simulink		

References:

1. Ramjee Prasad, Marina Ruggieri, Techology Trends in Wireless Communications, Artech House, 2003
2. Amitava Mukherjee, Somprakash Bandyopadhyay, Debashis Saha, Location Management and Routing in Mobile Wireless Networks, Artech House, 2003
3. Jochen H. Schiller, Mobile Communications, Addison Wesley, 2003
4. William Stallings, Wireless Communications and Networks, Prentince Hall, 2005.

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		- Summative evaluation (E) written exam (theory and problems)		- E, 50% (max. 5 pts.)
Applications		The level of acquired abilities and practical skills		- Practical evaluation (L) - planning a wireless network scenario using QualNet		- L, 50% (max. 5 pts.)
10.4 Minimum standard of performance						
$E \geq 5$ and $L \geq 4$ and $0.5E + 0.5L \geq 4.5$						

Date of filling in
01.10.2020

Course responsible
Professor
Tudor PALADE, PhD

Teachers in charge of applications
Associate Professor
Emanuel PUŞCHIŢĂ, PhD

Date of approval in the department
01.10.2020

Head of Communications Department
Professor Virgil DOBROTA, PhD