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-E42.00

2. Data about the subject

2.1	Subject name					Radio Communications					
2.2	Subject area					Electronics and Telecommunications Engineering					
2.3	Course responsible / lecturer					Professor Tudor PALADE, PhD					
2.4	Teachers in charge of applications					Assistant Professor Andra PASTRAV, Ph.D Assistant Professor Paul DOLEA, PhD					
2.5	Year of study	III	2.6	Semester	2	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			
III/2	Radio Communications	14	2		2	1	28		28	14	60	130	5

3.1	Number of hours per week	5	3.2	of which, course	2	3.3	applications	3
3.4	Total hours in the curriculum	70	3.5	of which, course	28	3.6	applications	42

Individual study	Hours
Manual, lecture material and notes, bibliography	28
Supplementary study in the library, online and in the field	5
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	21
Tutoring	2
Exams and tests	3
Other activities	1

3.7	Total hours of individual study	60
3.8	Total hours per semester	130
3.9	Number of credit points	5

4. Pre-requisites (where appropriate)

4.1	Curriculum	Passive Components, Electronic Devices and Circuits, Integrated Circuits, Signals Circuits and Systems
4.2	Competence	Relations and theorems for electric circuits, frequency response representation; operating principles for electronic devices: diode, operational amplifier, MOSFET and BJT transistors; use of electronic devices in electronic circuits; analysis methods for electronic circuits; voltage transfer characteristics; transfer function

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. C6. To solve wide-band telecommunications networks' specific problems: propagation in various transmission media, high frequency circuits and equipment (microwaves and optical).
Cross competences	N / A

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

7.1	General objectives	Developing skills in the design, simulation and measurement of circuits and radio systems
7.2	Specific objectives	1. Assimilation of theoretical knowledge for the design and simulation of radio circuits using advanced simulation programs (Microwave Office, Matlab, ADS, LabView etc.) 2. Obtaining skills and abilities necessary for measuring and testing circuits and radio systems

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	The fundamentals of electronic communication.	Heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative	Use of .ppt presentation, projector, blackboard
2	Wave propagation.		
3	Antennas and transmission lines.		
4	Amplitude modulation fundamentals.		
5	Amplitude modulator and demodulator circuits.		
6	Fundamentals of frequency modulation.		
7	Frequency modulation circuits.		
8	Digital communication techniques.		
9	Multiplexing and demultiplexing, transmission of binary data in		

	communication systems.		
10	Radio transmitters.		
11	Communication receivers.		
12	Satellite communication.		
13	Wireless technologies.		
14	Communication tests and measurements.		
8.2. Applications (lab)		Teaching methods	Notes
1	Safety, presentation and laboratory works	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers.
2	L1. The transmitter.		
3	L2. Receiver.		
4	L3. The PLL circuit.		
5	L4. Automatic gain control.		
6	L5. Amplitude Modulation		
7	L6. Demodulation of amplitude modulated signals.		
8	L7. Amplitude modulation BLD and BLU		
9	L8. Demodulation MA - BLD.		
10	L9. Demodulation MA - BLU.		
11	L10. Frequency modulation.		
12	L11. Demodulation frequency modulated.		
13	L12. Encoder remote control.		
14	Laboratory works recovery - according to the rules and programming and finalization of laboratory activity		
8.3. Applications (projects)		Teaching methods	Notes
1	P1 - physical models for MIMO channel	Didactic and experimental proof, team work	Use of laboratory instrumentation, computers, software simulators.
2	P2 - channel models based on stochastic geometry		
3	P3 - analytical models based on the propagation channel		
4	P4 - channel models based on correlations		
5	P5 – broadcasting radio channel modeling		
6	P6 - modeling wideband MIMO channel		
7	P7 - capacity of MU-MIMO and MIMO channel		
8	P8 - MIMO transmission algorithms - STBC		
9	P9 - MIMO transmission algorithms - V, H, D BLAST		
10	P10 - diversity techniques		
11	P11 – space diversity		
12	P12 - techniques for radiation lobe synthesis		
13	P13 - estimation techniques for angles of arrival - DoA		
14	P14 - channel state estimation methods		

Bibliography

1. Palade, T, s.a – Radiocomunicatii laborator, Ed. Mediamira,′99, Cluj, ISBN 973-97791-2-3
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3. Walke, B.H. – Mobile radio networks – Wiley&Sons, 2002, ISBN 0-471-97595-8.
4. Young, P.H.–Electronic Communication Techniques, Prentice Hall, 2003, ISBN 0-02-431201-0.
5. Karlson, B., s.a. - Wireless Foresight, Wiley&Sons, 2003, ISBN 0-471-85815-X.
6. Haykin, S. – Communication Systems, Wiley&Sons, 4th Edition, 2004, ISBN 0-471-17869-1.
7. Coleman, C.– An introduction to radio frequency engineering, Cambridge Univ. Press, 2005, ISBN 0-521-83481-3.
8. Hagen, J.B. - Radio-Frequency Electronics, Circuits and Applications, Cambridge University Press, 2009, ISBN 978-0-521-88974-2.
9. Ziemer, R.E., Tranter, W.H. – Principles of Communications – Systems, Modulation and Noise, John Wiley & Sons, 2010, ISBN 978-0-470-39878-4.
10. Palade, T., s.a. – Radiocomunicatii – Indrumator de laborator Vol I, U.T.Press, Cluj-Napoca 2012, ISBN 978-973-662-684-5.

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		Summative evaluation written exam - theory topics and problems		50%
Applications		The level of acquired abilities		Continuous formative evaluation and practical laboratory test		50%
10.4 Minimum standard of performance						
Answer correctly at least one subject of theory, writing appropriate design relationships needed to solve the problem and obtain at least the mark 5 for laboratory activities						

Date of filling in
01.10.2018

Course responsible
Professor
Tudor PALADE, PhD

Teachers in charge of applications
Assist. Prof. Andra PASTRAV, Ph.D.
Assist. Prof. Paul DOLEA, PhD