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, Applied Electronics
1.7	Form of education	Full time
1.8	Subject code	TST-E24.00, EA-E24.00

2. Data about the subject

2.1	Subject name					Microwaves					
2.2	Subject area					Electronics and Telecommunications Engineering					
2.3	Course responsible/lecturer					Assistant Professor Andra PASTRAV, PhD					
2.4	Teachers in charge of applications					Assistant Professor Andra PASTRAV, PhD					
2.5	Year of study	II	2.6	Semester	2	2.7	Assessment	Exam	2.8	Subject category	DD/DI

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			
II/2	Microwaves	14	2		2		28		28		44	100	4

3.1	Number of hours per week	4	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	20
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	22
Tutoring	3
Exams and tests	3
Other activities	

3.7	Total hours of individual study	44
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites

4.1	Curriculum	Fundamentals of Electrotechnics, Passive Electronic Components and Circuits, Fundamental Electronic Circuits, Digital Integrated Circuits, Signals Theory
4.2	Competence	No

5. Requirements

5.1	For the course	Video-projector, screen, whiteboard
5.2	For the applications	PCs with Internet access

6. Specific competences

Professional competences	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology C2. To apply basic methods for signal acquisition and processing 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 the competences regarding the use, analysis and (re)design of fundamental microwave circuits.
7.2	Specific objectives	1. Solidify their understanding of wave propagation on transmission lines and expand it to include stripline and microstrip structures, as well as waveguides of rectangular and circular cross section. 2. Learn to analyze the network behavior of multiport microwave systems. 3. Be able to design impedance matching networks, including multi-section broadband transformers. 4. Be able to analyze and design passive microwave components, including microwave resonators, power dividers, hybrid junctions, and microwave filters. 5. The students will, through labs, develop an intuition and physical feeling for microwave phenomenon and get first hands-on experience with microwave components and their characterization techniques.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Transmission Line Theory. Field Analysis on Transmission Lines	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	Transmission Linea and Waveguides. General Solutions for TEM, TM and TE Waves		
3	Rectangular Waveguide. TE and TM Modes		
4	Coaxial Line. TEM Modes and Higher-Order Modes		
5	Stripline and Microstrip		
6	Impedance Matching and Tunning		
7	Matching with Lumped Elements (L Network). The Quarter-Wave Transformer		
8	Microwave Resonators		
9	Power dividers and Directional Couplers		
10	Waveguide Directional Couplers. Coupled Line Directional Couplers		
11	Theory and Design of Ferrimagnetic Components. Ferrite Isolators, Ferrite Phase Shifters and Ferrite Circulators		
12	Noise in Microwave Circuits. Diods, Transistors, Integrated Circuits.		
13	Microwave Amplifiers		
14	Microwave Oscillators, Detectors and Mixers		
8.2. Applications (lab)		Teaching methods	Notes
1	Laboratory Work Regulations. Applications and Equipment Presentation. Software Tool for Wave Propagation Simulation Mefisto-2D	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, magnetic board
2	Wave Propagation on TEM Transmission Lines		
3	Microwave Propagation Along Rectangular Waveguides		
4	High-Order Propagation Modes Analysis in Rectangular Waveguides		
5	Microstrip Lines		
6	Impedance Computation using Smith's Chart		
7	Impedance Matching		
8	Power and Attenuation Measurements		
9	Directional Couplers, Power Dividers and Hybrid Junctions		
10	Microwave Antennas – Parabolic Dish		
11	Microwave Antennas - Horn Antenna		
12	Microwave Link Budget		
13	Industrial Applications of the Magnetron. Microwave Oven.		
14	Make-up Lessons based on Regulations and the Teacher's Schedule		

Bibliography

1. Palade, T. – Tehnica Microundelor, Genesis, Cluj-Napoca, 1997, ISBN 973-98204-3-3
2. D, Pozar – Microwave Engineering, 4th Edition, John Wiley & Sons, 2012. ISBN: 978-0-470-63155-3.
3. Nicolau, Ed.-Manualul inginerului electronist–Radiotehnica I, II, III-Ed.Teh ′88, ISBN973-31-0116-8
4. Palade, T. – Tehnica Microundelor. Culegere de probleme, UTC-N, 1992.
5. Baican, R. – Circuite integrate de microunde – Promedia Plus, Cluj, 1998, ISBN 973-97377-6-5
6. N. Crişan, L. Cremene, T. Palade, E. Puşchiţă, *Microunde – Aplicaţii (Microwave – Applications)*, Volumul 1, U.T. Press, 2008
7. T. Palade, A. Moldovan, E. Puşchiţă, I. Vermeşan, R. Colda, *Microunde – Aplicaţii (Microwave – Applications)*, Volumul 2, U. T. Press, 2009

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 written exam (theory and problems)		- T, max 2.5 pts. 25% - E, max 2.5 pts. 25%
Applications		The level of acquired abilities and practical skills		Continuous formative evaluation – 3 tests: - practical lab test - problem solving tests		- L, max. 5 pts. 50%
10.4 Minimum standard of performance						
$L \geq 5$ and $E \geq 5$ and $T \geq 5$ and $0.5L+0.25T+0.25E \geq 4.5$						

Date of filling in	Course responsible	Teachers in charge of applications
01.10.2018	Assist.Prof. Andra PASTRAV, PhD	Assist.Prof. Andra PASTRAV, PhD