

## Specification for the book of courses

<b>Study program</b>	Communications and Information Technologies			
<b>Module</b>	System Engineering and Radio-Communications			
<b>Type and level of studies</b>	Master studies			
<b>The name of the course</b>	Circuit Design for 5G systems			
<b>Lecturer (for lectures)</b>	Pronić-Rančić R. Olivera, Maleš-Ilić P. Nataša			
<b>Lecturer/associate (for exercises)</b>	Atanasković S. Aleksandar, Stošić P. Biljana			
<b>Lecturer/associate (for OFE)</b>	Atanasković S. Aleksandar, Stošić P. Biljana			
<b>Number of ECTS</b>	4	<b>Course status (obligatory/elective)</b>	Elective	
<b>Prerequisites</b>				
<b>Course objectives</b>	Acquiring theoretical and practical knowledge in the field of design of passive and active microwave and millimeter-wave circuits for applications in 5G systems.			
<b>Course outcomes</b>	Training students for work in modern software packages for design, analysis and optimization of microwave and millimeter-wave circuits. Knowledge of topology, principles of operation and procedure for designing passive and active circuits for use in microwave and millimeter-wave range applications in 5G systems. Design of planar microwave and millimeter-wave circuits and their characterization in the measurement procedure using laboratory equipment.			
<b>Course outline</b>				
<b>Theoretical teaching</b>	Modern approach to circuit design (CAD techniques) - modeling, simulation and optimization of the design process. Design of passive microwave and millimeter-wave circuits. RF and microwave amplifiers - two-port power gains, stability. Single stage transistor amplifier design. Design of amplifiers for maximum gain. Low-noise amplifiers. Power amplifiers - basic features and applications. Classes of power amplifiers. Harmonic balance analysis. Oscillators. Detectors. Mixers. Design of microwave transceivers. Software packages for the analysis, design and optimization of microwave and millimeter-wave circuits.			
<b>Practical teaching (exercises, OFE, study and research)</b>	Auditory exercises involve solving problems in areas that are covered by the content of the subject. Research work includes individual and/or team work on designing specific circuits, their realization and verification of results by the measurement process.			
<b>Textbooks/references</b>				
1	G. Kompa, Practical Microstrip Design and Applications, Artech House, 2005.			
2	D. Pozar, Microwave Engineering, 3rd edition, John Wiley & Sons, Inc, 2005.			
3	A. Georgiadis, H. Rogier, L. Roselli, P. Arcioni, Microwave and Millimeter Wave Circuits and Systems: Emerging Design, Technologies and Applications 1st Edition, John Wiley & Sons, Ltd. 2013.			
4	B. Milovanović, V. Marković, N. Maleš - Ilić, O. Pronić - Rančić, Microwave technique (in Serbian), Unigraf, 2009.			
5	O. Pronić, V. Marković, N. Maleš – Ilić, B. Milovanović, Microwave electronics (in Serbian), Faculty of electronic engineering, Niš, 2013.			
<b>Number of classes of active education per week during semester/trimester/year</b>				
<b>Lectures</b>	<b>Exercises</b>	<b>OFE</b>	<b>Study and research work</b>	<b>Other classes</b>
2	1	1	0	0
<b>Teaching methods</b>	Lectures, auditory exercises, laboratory work, homework, consultations.			
<b>Grade (maximum number of points 100)</b>				
<b>Pre-exam duties</b>	<b>Points</b>	<b>Final exam</b>	<b>Points</b>	
<b>Activity during lectures</b>	5	<b>Written exam</b>	25	
<b>Exercises</b>	20	<b>Oral exam</b>	25	
<b>Colloquia</b>	25			
<b>Projects</b>				