



Subject card

Subject name and code	Wireless Devices Design, PG_00048105						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2023	Academic year of realisation of subject				2026/2027	
Education level	first-cycle studies	Subject group				Optional subject group Subject group related to scientific research in the field of study	
Mode of study	Full-time studies	Mode of delivery				at the university	
Year of study	4	Language of instruction				Polish	
Semester of study	7	ECTS credits				5.0	
Learning profile	general academic profile	Assessment form				exam	
Conducting unit	Department of Microwave and Antenna Engineering -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Krzysztof Nyka					
	Teachers	dr hab. inż. Krzysztof Nyka					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	15.0	0.0	75
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	75		5.0		45.0	125
Subject objectives	The aim is an introduction to analysis, design and measurements of basic RF circuits and components - passive (splitters, couplers, filters), active (amplifiers, oscillators) and semiconductor devices (diodes, transistors) - applied in wireless systems. Students will learn practically the operation of Keysight ADS software which is an advanced and professional tool for analysis and design of RF and microwave circuits. Also some exemplary wireless systems will be introduced, such as technologies for internet of things (IoT), radio identification (RFID) and wireless sensor networks (WSN).						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment		K_U36 analyzes and designs RF active and passive circuits applied in wireless communication systems using advanced CAD simulation tools. [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools	
	[K6_W34] Knows the characteristics of telecommunications channels, methods of securing information, modulation systems, methods of access to the channel.		knows principle of operations of basic RF circuits and basic requirements concerning their applications in wireless communication systems			[SW1] Assessment of factual knowledge	

## Subject contents

### LECTURE

Binomial and Chebyshev multisection matching transformers design

Nonuniform matching transformers design

Multisection coupled line directional couplers design

Nonuniform coupled line directional coupler design

Multisection hybrid junctions and couplers design

T junction and Wilkinson power divider design

Filter design using low pass band filter prototype

Schottky diodes and design of RF diode detectors

PIN diodes and design of RF switches and attenuators

Small signal amplifier – unilateral design with transistor as active 2-port

RF and microwave transistors. – BJT/HBT and MESFET/HEMT

Small signal amplifier with real transistor – conjugate match design

### PROJECT

Design of ideal transistor amplifier with LC matching

Design of amplifier with real LC elements and sections of transmission lines

Design of amplifier with large signal model of transistor – introduction to Agilent ADS

### LABORATORY

Investigation of the dielectric substrates for hybrid microwave integrated circuits.

The impedance matching, stubs, quarter wave transformer.

The broadband matching circuit synthesis.

The lumped element matching circuits.

The branch couplers.

Prerequisites and co-requisites	Electrodynamics, (Theory of EM field), Basic RF electronics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory	50.0%	20.0%
	Project	50.0%	20.0%
	Lecture	40.0%	60.0%
Recommended reading	Basic literature	Pozar D. "Microwave Engineering" John Wley&Sons 1998  Keysight ADS 2015 Documentation	
	Supplementary literature	none	
	eResources addresses	Adresy na platformie eNauczenie:	
Example issues/ example questions/ tasks being completed	What are the possible conditions of impedance matching used in RF amplifier?  Draw a general block schematic of a transistor with matching networks.		
Work placement	Not applicable		

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