GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Wireless Devices Design, PG_00048105		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2023/2024
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 dr hab. inż. Łukasz Kulas inż. Kamil Trzebiatowski	

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_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
[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	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

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 mach 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.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Electrodynamics, (Theory of EM field), Basic RF electronics</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture</td><td>40.0%</td><td>60.0%</td></tr>
<tr><td>Project</td><td>50.0%</td><td>20.0%</td></tr>
<tr><td>Laboratory</td><td>50.0%</td><td>20.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Pozar D. "Microwave Engineering" John Wley&Sons 1998

Keysight ADS 2015 Documentation</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">none</td></tr>
<tr><td>eResources addresses</td><td colspan="2">Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">What are the possible conditions of impedance matching used in RF amplifier?

Draw a general block schematic of a transistor with matching networks.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
</table>