GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Integrated Passive Circuits for Wireless Communications, PG_00048664		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Optional subject group Specialty 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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Microwave and Antenna Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Adam Lamęcki	
	Teachers	dr hab. inż. Adam Lamęcki mgr inż. Tobiasz Dryjański	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45	6.0	24.0	75

Subject objectives	Characterization of the microwave integrated passive components and methods of their design

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U03] can design, according to required specifications, and make a complex 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	The student acquainte with the technology and methods of designing integrated microwave circuits, such as; lumped elements, signal divider directional and branch couplers, phase shifters, ferrite non-reciprocal circuits. Modeling of the devices use the scattering matrix obtained from their equivalent circuit and fields analysis	[SU2] Assessment of ability to analyse information
[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	The student is able to use CAD tools in the form of electromagnetic field simulators and high-frequency circuit simulators to design selected classes of passive systems.	[SU4] Assessment of ability to use methods and tools
[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	The student knows the principles of using the methods of analysis and modeling of the multiport junctions to develop their own software and their analysis using professional software	[SW1] Assessment of factual knowledge
[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	The student understands the principles of operation of designed systems. He is able to apply new elements and materials for their construction as well as knows the methods of their miniaturization	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture
1. Integrated transmission lines, dispersion characteristics , characteristic impedances, volume and surface modes 2. Integrated lines excitation, connectors and mode transformers 3. Even odd mode analysis of the scattering matrix of the multi-port junction 4. Integrated loads and attenuators 5. Multisection impedance matching transformers analysis and design 6. Inhomogeneous matching transformers analysis and design 7. Coupling between electromagnetic wave and dielectric material, inte-grated phase shifters and polarizers 8. Non-reciprocal components 9. UWB integrated planar and layered directional couplers 10. Lange coupler , bimodes equivalent circuits and its wave parameters 11. Design of the UWB multisection and tandem directional couplers. 12. Introduction to microwave filter design.

Prerequisites and co-requisites

Completion of courses:

- Electromagnetic fields and waves

- High frequency electronics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	50.0%	50.0%
Practical exercise	50.0%	50.0%

Recommended reading

Basic literature	1. A. Lamęcki " Integrated passive devices" lecture notes, 2..D.Pozar"Microwave engineering" j.Willey&Sons, 1998

	Supplementary literature	[2] Janusz Dobrowolski, Scattering Parameters in RF and Microwave Circuit Analysis and Design , Artech, 2016. [3] Marco Guglielmi, R. Sorrentino, and Giuseppe Conciauro. Advanced Modal Analysis: CAD Techniques for Waveguide Components and Filter (1st. ed.). John Wiley & Sons, Inc., USA, 1999 [4] Leo G. Maloratsky, Passive RF & microwave integrated circuits, Elsevier, 2004 [5] Voinigescu, S. High-Frequency Integrated Circuits (The Cambridge RF and Microwave Engineering Series). Cambridge: Cambridge University Press, 2013 [6] Hanqiao Zhang, Steven Krooswyk, and Jeffrey Ou. High Speed Digital Design: Design of High Speed Interconnects and Signaling (1st. ed.). Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 2015 [7] Rainee N. Simons, Coplanar Waveguide Circuits, Components, and Systems, John Wiley & Sons, Inc., 2001 [8] Hee-Ran Ahn, Asymmetric Passive Components in Microwave Integrated Circuits, John Wiley & Sons, Inc., 2006 [9] Richard K. Ulrich (Editor), Leonard W. Schaper (Editor), Integrated Passive Component Technology, Wiley-IEEE Press, 2010 [10] Jia-Sheng Hong, M. J. Lancaster, Microstrip Filters for RF/ Microwave Applications, John Wiley & Sons, Inc., 2001
	eResources addresses	
Example issues/ example questions/ tasks being completed	Define equivalent circuits of the microstrip Wilkinson power divider for its even and odd excitation Discuss the basic properties of the coplanar line and explain why this line is a common choice for implementing monolithic microwave systems List the microwave couplers with large coupling (e.g. 3dB) that you are familiar with with their properties.	
Practical activites within the subject	Not applicable	

Document generated electronically. Does not require a seal or signature.