GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Integrated Passive Circuits for Wireless Communications, PG_00048664 | | |
| Field of study | Electronics and Telecommunications | | |
| Date of commencement of studies | February 2025 | Academic year of realisation of subject | 2024/2025 |
| Education level | second-cycle studies | Subject group | Optional subject group<br>Specialty subject group<br>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 | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr hab. inż. Adam Lamęcki | |
| | Teachers | dr hab. inż. Adam Lamęcki<br>mgr inż. Damian Duraj | |

| Lesson types and methods of instruction | 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 |

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

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [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_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_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**

1. Integrated transmission lines, dispersion characteristics , characteristic impedances, volume and surface modes 2. Integrated lines excitation, connectors and mode transformers 3. Dispersion characteristics of the integrated periodical LH and RH lines with lumped elements 4. Even odd mode analysis of the scattering matrix of the multi-port junction 5. Microwave resistors equivalent circuits, integrated loads and attenuators 6. Multisection impedance matching transformers analysis and design 7. Inhomogeneous matching transformers analysis and design 8. Coupling between electromagnetic wave and dielectric material, integrated phase shifters and polarizers 9. Ferroelectric phase shifters 10. Diode control devices, attenuators and phase shifters 11. UWB integrated planar and layered directional couplers 12. Lange coupler , bimodes equivalent circuits and its wave parameters 13. Design of the UWB multisection and tandem directional couplers

**Prerequisites and co-requisites**

No requirements

**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**

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| Basic literature | 1. J. Mazur" Integrated passive devices" lecture notes, mwave .eti.pg.gda.pl 2..D.Pozar"Microwave engineering" j.Willey&Sons, 1998 3.A.L. Baden Fuller " Ferrites at microwave frequencies" Peter Peregrinus , UK 1987 |
| Supplementary literature | No requirements |
| eResources addresses | Adresy na platformie eNauczanie: |

**Example issues/ example questions/ tasks being completed**

Define equivalent circuits of the microstrip Wilkinson power divider for its even and odd excitation

**Work placement**

Not applicable

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