



Subject card

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|--|---|---|---|--|--|------------|-----|
| Subject name and code | Wireless Devices Design, PG_00048105 | | | | | | |
| Field of study | Electronics and Telecommunications | | | | | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | | | 2027/2028 | | |
| 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_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 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.

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| 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 |
| | Lecture | 40.0% | 60.0% |
| | Project | 50.0% | 20.0% |
| | Laboratory | 50.0% | 20.0% |
| 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 | | |