



Subject card

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|---|---|--|----------|-------------------------------------|--|------------|-----|
| Subject name and code | High Frequency Measurement Automation , PG_00048663 | | | | | | |
| Field of study | Electronics and Telecommunications | | | | | | |
| Date of commencement of studies | February 2024 | Academic year of realisation of subject | | | 2023/2024 | | |
| Education level | second-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 | 1 | Language of instruction | | | Polish | | |
| Semester of study | 1 | ECTS credits | | | 2.0 | | |
| 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. Rafał Lech | | | | | |
| | Teachers | dr hab. inż. Rafał Lech | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 15.0 | 0.0 | 15.0 | 0.0 | 0.0 | 30 |
| | 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 | 30 | | 4.0 | | 16.0 | 50 |
| Subject objectives | Familiarizing yourself with the measurements methods and techniques of basic parameters which are necessary, from a practical point of view, to evaluate the performance of the RF devices and systems. | | | | | | |

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| Learning outcomes | Course outcome | Subject outcome | Method of verification |
| | [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 knows the structure of the spectrum analyzer and network analyzer in the full version as well as its simplified implementations and on this basis selects the appropriate calibration method to calibrate the microwave analyzer in the high frequency range and carry out measurements of the basic parameters of RF elements. | [SW1] Assessment of factual knowledge |
| | [K7_W06] Knows and understands, to an increased extent, the basic processes taking place in the life cycle of devices, facilities and technical systems. | The student knows the structure of the spectrum analyzer and network analyzer, which allows understanding the principles of their operation and selection of appropriate calibration methods. | [SW1] Assessment of factual knowledge |
| | [K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices | The student is able to interpret and process measurement results. The student knows the embedding and de-embedding methods that allow the measured object to be embedded into a network of virtually existing systems, or to remove unwanted parts of the measured object from the measurement results. | [SW1] Assessment of factual knowledge |
| | [K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions | The student measures the parameters of single or multiport RF systems, using a network analyzer, spectrum analyzer or reflectometer, and assesses the operation of the measured system based on the obtained results. | [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment |
| | [K7_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions | The student is able to choose the appropriate method of network analyzer calibration, he/she can calibrate the microwave analyzer in the high frequency range and perform measurements of basic parameters of RF elements. | [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment |
| Subject contents | <ol style="list-style-type: none"> 1. Measuring equipment 2. Automated measurements of scattering parameters of multiport devices: electronic calibrators, calibration techniques, data processing, time reflectometry 3. Vector network analyzer: measurement capabilities, structure, simplified implementations, calibration 4. Spectrum Analyzers: measurement capabilities, structure, signal sampling techniques, the choice of detector 5. Techniques for locating faults in transmission circuits 6. Techniques to extend the capabilities of measuring microwave network analyzers | | |
| Prerequisites and co-requisites | | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Exam | 50.0% | 50.0% |
| | Lab. reports | 50.0% | 50.0% |
| Recommended reading | Basic literature | <ol style="list-style-type: none"> 1) Christoph Rauscher: "Fundamentals of Spectrum Analysis", Rohde & Schwarz GmbH & Co. KG, 5th Ed., Monachium, 2007 2) Michael Hiebel: "Fundamentals of Vector Network Analysis", Rohde & Schwarz GmbH & Co.KG, 1st Ed., Monachium, 2007 | |
| | Supplementary literature | brak | |
| | eResources addresses | Adresy na platformie eNauczanie: Automatyzacja miernictwa bardzo wysokiej częstotliwości - 23/24 - Moodle ID: 36736 https://nauczanie.pg.edu.pl/moodle/course/view.php?id=36736 | |
| Example issues/ example questions/ tasks being completed | <ol style="list-style-type: none"> 1. Briefly compare the advantages and disadvantages of hardware and software reflectometry 2. Time reflectometry in RF measurements 3. Briefly compare electronic and mechanical calibration of vector network analyzer 4. Reflectometric measurement method for measuring reflection parameters. 5. Block diagram of the reflectometer for measuring the modules of reflection and transmission parameters. 6. Calibration techniques of vector network analyzer. 7. Discuss selected reflectometric system to measure reflection parameter. 8. Block diagram and operation of the vector network analyzer. 9. Discuss the selected implementations of simplified vector network analyzer. | | |
| Work placement | Not applicable | | |