GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Reception of Radio Signals, PG_00064095 | | |
| 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<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 Radiocommunication Systems and Networks -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Jacek Stefański | |
| | Teachers | prof. dr hab. inż. Jacek Stefański<br>dr hab. inż. Jarosław Sadowski | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 15.0 | 15.0 | 0.0 | 15.0 | 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 | 5.0 | 25.0 | 75 |

**Subject objectives**

Acquaint students in detail with construction and operation of a modern radio communications receiver

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K7_K02] is ready to provide critical evaluation of received content and to acknowledge the importance of knowledge in solving cognitive and practical problems | The student knows and can use specialized vocabulary in the field of modern radio communication. | [SK4] Assessment of communication skills, including language correctness |
| [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 can formulate the radio link budget and explain the influence of the receiver parameters on this budget. The student solves simple tasks on the receiver's noise ratio, can explain the causes and effects of intermodulation distortion in the receiver. | [SU4] Assessment of ability to use methods and tools |
| [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 basic elements of the theory of radio reception with particular emphasis on digital systems and knows the reception techniques used in modern cellular systems. | [SW1] Assessment of factual knowledge |

<table>
<tr><td>Subject contents</td><td>Course content – lecture<br>1. Who invented radio ? 2. Digital and Analog Radio Communication System 3. Block Diagram of Radio Communication System 4. Shannon Theory 5. Radio Link Budget 6. Criteria of Speech and Data Signals Reception 7. Basic Parameters of Receiver 8. Noise of Receiver 9. Noise Figure and Noise Temperature. 10. Analog Receiver Scheme 11. Digital Receiver Scheme 12. Dynamic Range in Digital Receiver 13. Optimal Reception of Digital Signals in Gaussian Channel 14. Signal Reception Techniques for 2G Systems 15. Signal Reception Techniques for 3G Systems 16. Signal Reception Techniques for 4G and 5G Systems<br>Course content – exercises<br>1. Decibel definition reminder; 2. Radio link budget; 3. System gain; 4. Noise figure and noise temperature; 5. Spectrum efficiency of signal modulation; 6. Frequency mirror in the receiver; 7. Noise characteristic for radio communication system; 8. Power spectrum density of radio signal; 9. Intermodulation distortions; 10. Amplifiers, attenuators and mixers; 11. Analog to digital converter in the receiver; 12. Satellite wireless systems; 13. Transceivers.<br>Course content – project<br>1. Fundamentals of digital signal processing and spectral analysis; 2. Demodulation of radio signals with analog modulations; 3. Demodulation of radio signals with digital modulations; 4. Detection and decoding of data from digital signals with known transmission structure; 5. Detection and decoding of data from digital signals with unknown transmission structure.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>No requirements</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Implementation of project tasks</td><td>50.0%</td><td>30.0%</td></tr>
<tr><td>Written exam (lecture + practice)</td><td>50.0%</td><td>70.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Tomasi W., Advanced Electronic Communications Systems, Prentice Hall, Sixth Edition, 2014. 2. Drentea C., Modern Communications Receiver Design and Technology, Artech House, 2010. 3. Fazel K., Kaiser S., Multi-Carrier and Spread Spectrum Systems. From OFDM and MC-CDMA to LTE and WiMAX, 2nd Edition, Wiley & Sons, 2008. 4. Schaub K. B., Kelly J., Production Testing of RF and System-on-a-Chip Device for Wireless Communications, Artech House, 2004. 5. Proakis J. G., Digital Communications, McGraw-Hill, 1989. 6. Mitola J., Software Radio Architecture, John Wiley & Sons, 2000.</td></tr>
<tr><td>Supplementary literature</td><td>No requirements</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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