GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

| | | | |
|---|---|---|---|
| Subject name and code | Echolocation Systems, PG_00048131 | | |
| Field of study | Electronics and Telecommunications | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | 2026/2027 |
| Education level | first-cycle studies | Subject group | Optional 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 | 3 | Language of instruction | Polish |
| Semester of study | 6 | ECTS credits | 3.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Signals and Systems -> Faculty of Electronics, Telecommunications and Informatics | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Roman Salamon | |
| | Teachers | prof. dr hab. inż. Roman Salamon | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 30.0 | 0.0 | 15.0 | 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 | 3.0 | 27.0 | 75 |

**Subject objectives**

Understanding the basic principles, technical solutions and parameters of echolocation systems.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_W35] Knows the concepts of the technique of signal transmission, operation of telecommunications networks and multimedia services and the rules for providing them | Student describes principles of operation, functional diagrams and signal processing algorithms in radars, sonars, ultrasonographs and echolocation alarm systems. | [SW1] Assessment of factual knowledge |
| [K6_U06] can analyse the operation of components, circuits and systems related to the field of study, measure their parameters and examine technical specifications | He examines relationships occurring between technical and operating parameters of echolocation systems. He makes choice of echolocation system solutions and their operational parameters for tasks they meet in specific applications. He analyzes modes of technical implementation of systems in modern technology and compares their costs. He supports basic underwater acoustic devices and interprets the information obtained about observed environment. | [SU3] Assessment of ability to use knowledge gained from the subject |

| | |
|---|---|
| Subject contents | 1. Course organization, requirements, consultations.<br>2. General principles of echolocation systems functioning.<br>3. Echolocation systems purposes and classification.<br>4. Functional model of echolocation systems.<br>5. Range, angular and range resolution, time of space sector scanning.<br>6. Space sector scanning techniques.<br>7. Single- and multi-beam systems.<br>8. Narrowband sounding signals: time length, spectrum and autocorrelation function.<br>9. Frequency modulated sounding signals: time length, spectrum and autocorrelation function.<br>10. Ambignity function.<br>11. Antennas of echolocation systems.<br>12. Definition of directivity pattern.<br>13. Techniques of directivity patterns determination.<br>14. Examples of echolocation systems antennas directivity patterns.<br>15. Directivity index.<br>16. Source level.<br>17. General characteristics of echolocation systems channels.<br>18. Space distribution of propagation velocity.<br>19. Refraction and wave propagation trajectories.<br>20. Wave reflection, echolocation targets.<br>21. Reverberations.<br>22. Noises in echolocation channels.<br>23. Receiver electric noise.<br>24. Echo signals.<br>25. Problem of echo signals detection and parameters estimation.<br>26. Detection as testing of hypotheses.<br>27. Reception of a known signal with Gaussian noise background, matched receiver.<br>28. Reception sinusoidal signal of a unknown frequency with Gaussian noise background.<br>29. Detection threshold.<br>30. Receiver operation characteristics ROC.<br>31. Receiver processing gain.<br>32. Range equation.<br>33. Range equation parameters.<br>34. Determination of technical parameters of the system from the range equation.<br>35. Techniques of echo signals imaging.<br>36. Aviation radiolocation systems.<br>37. Marine radiolocation systems.<br>38. Acoustics waves in echolocation systems<br>39. Hydrolocation systems in navigation, fishery and oceanology.<br>40. Military hydrolocation systems.<br>41. Ultrasonography.<br>42. Defectoscopy.<br>43. Summary. |
| Prerequisites and co-requisites | |
| Assessment methods and criteria | |

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Practical exercise | 60.0% | 40.0% |
| Midterm colloquium | 60.0% | 60.0% |

| | | |
|---|---|---|
| Recommended reading | Basic literature | A. Nowicki "Diagnostyka ultradźwiękowa" Makmed, 2000<br>R. Salamon: Systemy hydrolokacyjne, Wyd. GTN, 2006<br>M. Skolnik: Radar Handbook, McGraw-Hill Professional, 2008 |
| | Supplementary literature | No requirements |
| | eResources addresses | Adresy na platformie eNauczanie: |
| Example issues/ example questions/ tasks being completed | | |
| Work placement | Not applicable | |

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