GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

| | | | |
|---|---|---|---|
| Subject name and code | Kalman Filters and Stochastic Control, PG_00048447 | | |
| Field of study | Automatic Control, Cybernetics and Robotics | | |
| Date of commencement of studies | February 2024 | Academic year of realisation of subject | 2024/2025 |
| Education level | second-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 | 1 | Language of instruction | Polish |
| Semester of study | 2 | ECTS credits | 1.0 |
| Learning profile | general academic profile | Assessment form | exam |
| Conducting unit | Department of Automatic Control -> Faculty of Electronics, Telecommunications and Informatics | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Maciej Niedźwiecki | |
| | Teachers | prof. dr hab. inż. Maciej Niedźwiecki | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 15.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 |

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 | 15 | 2.0 | 8.0 | 25 |

**Subject objectives**

Introducing design methods for regulation systems working in random conditions.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K7_W05] Knows and understands, to an increased extent, methods of process and function support, specific to the field of study. | The student has advanced knowledge about the method of supporting processes and functions related to the field of study | [SW1] Assessment of factual knowledge |
| [K7_W02] Knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study | Students know basic kinds of random processes and Markow's decision problems | [SK5] Assessment of ability to solve problems that arise in practice<br>[SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools<br>[SW1] Assessment of factual knowledge |

<table>
<tr><td>Subject contents</td><td>1. Principles of minimum variance (MV) control<br>2. MV regulators for ARMAX systems<br>3. Stability of MV regulators<br>4. Diophantine equations and their solutions<br>5. MV tracking of a reference signal<br>6. Limitations and drawbacks of MV control<br>7. Moving average (MA) control<br>8. Linear quadratic (LQ) control principles<br>9. Design of LQ regulators<br>10. Principles of minimum variance estimation<br>11. Introduction to Kalman filtering – conditional densities of Gaussian variables<br>12. Prediction, filtration and smoothing of stochastic signals<br>13. Kalman predictor and Kalman filter<br>14. Properties of Kalman filter<br>15. Stationary Kalman filter – Wiener filter<br>16. Kalman filter as an optimal state observer<br>17. Application of Kalman filter to airplain tracking<br>18. Numerical safeguards used in Kalman filtering<br>19. Extended Kalman filter (EKF)<br>20. Application of EKF to localization of an automous guided vehicle<br>21. LQ regulators in state space<br>22. Separation theorem<br>23. Robustness of LQ regulators</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></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>Midterm colloquium</td><td>50.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Lewis F., "Optimal Estimation", Wiley, 1986</td></tr>
<tr><td>Supplementary literature</td><td>No requirements</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>