GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

| | | | |
|---|---|---|---|
| Subject name and code | Computational Algorithms, PG_00047600 | | |
| Field of study | Automatic Control, Cybernetics and Robotics | | |
| Date of commencement of studies | October 2026 | Academic year of realisation of subject | 2028/2029 |
| 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 | 5 | ECTS credits | 2.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Automatic Control -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Krzysztof Cisowski | |
| | Teachers | dr inż. Krzysztof Cisowski | |

**Lesson types**

| 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 | 2.0 | 18.0 | 50 |

**Subject objectives**

Introducing students to basic algorithms of numerical methods and algorithms implementation problems.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study | Student describes and knows how to put into practice the basic algorithms for solving systems of linear equations.<br>Student describes and knows how to put into practice the basic algorithms for solving nonlinear equations and systems of nonlinear equations.<br>The student describes and knows how to use in practice the basic methods of interpolation and approximation.<br>The student describes and knows how to use in practice the basic methods of integration, differentiation and solving differential equations | [SU4] Assessment of ability to use methods and tools<br>[SW1] Assessment of factual knowledge |
| [K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn | Student describes and knows how to use in practice algorithms of numerical methods for analysis of control systems | [SU4] Assessment of ability to use methods and tools |

<table>
<tr><td>Subject contents</td><td>Course content – lecture<br>1. Introduction to numerical analysis: errors classification. 2. Root-finding algorithms: bisection method, NewtonRaphson method 3. Root-finding algorithms: secant method, regula falsi method, fixed point iteration. 4. Function interpolation: Lagrange method, Chebyshev method, trigonometric interpolation. 5. Finite differences. Stirling"s interpolation formula, I and II Newton"s interpolation formulas. 6. Function approximation: minimum mean square error (MMSE) approximation for continuous and discrete case. 7. Discretre MMSE approximation based on Gram polynomials and trigonometric polynomials. 8. Approximation using empirical formulas. 9. Direct methods of solving of linear equations systems. Gaussian elimination. 10. Triangular matrix decompositions methods: LU decomposition, QR decomposition. Triangular matrix inversion. 11. Iterative methods of solving of linear equations systems: Jacobi method, Gauss-Seidel method. 12. Methods of solving of nonlinear equations systems: steepest-descent method, Newton-Raphson method. 13. Numerical integration: trapezium rule, Simpson"s rule. 14. Numerical differentiation. Methods of solving of differential equations systems: Euler method, Runge-Kutta method. 15. Discrete Fourier transform (DFT) – fast Fourier transform algorithm (FFT).</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>Projects</td><td>51.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>A. Szatkowski, J. Cichosz, Metody numeryczne podstawy teoretyczne, Wydawnictwa Politechniki Gdańskiej, Gdańsk 2002. T. Ratajczak, Metody numeryczne, przykłady i zadania, Wydawnictwa Politechniki Gdańskiej, Gdańsk 2006. Z. Fortuna, J. Wąsowski, B. Macukow, "Metody numeryczne", seria Elektronika, Informatyka, Telekomunikacja, WNT Warszawa 2009. M. Dryja, J. i M. Jankowscy, Przegląd metod i algorytmów numerycznych, WNT, W-wa 1988. R. Chassaing, D. Reay, Digital signal processing and Applications with the C6713 and C6416 DSK, Wiley-Interscience 2008.</td></tr>
<tr><td>Supplementary literature</td><td>No requirements</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<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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