GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

| | | | |
|---|---|---|---|
| Subject name and code | Advanced Techniques of DSP, PG_00048679 | | |
| Field of study | Electronics and Telecommunications | | |
| Date of commencement of studies | February 2023 | Academic year of realisation of subject | 2023/2024 |
| 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 | 2.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Janusz Smulko | |
| | Teachers | dr inż. Arkadiusz Szewczyk<br>prof. dr hab. inż. Janusz Smulko | |

| 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 | 15.0 | 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 | Mastering knowledge of the selected advanced methods of analyzing and signal processing. The method are selected by focusing on applications in engineering practice. The methods are illustrated with exemplary, engineering applications. The methods should help students in solving problems related to measurement and control systems, which use the signals collected from various sensors and systems. |

## Learning outcomes

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n- appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n- application of appropriate methods and toolsn | Student can apply analysis methods to solve metrology problems. | [SU5] Assessment of ability to present the results of task<br>[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. | Knowledge of the selected DSP algorithms. | [SW2] Assessment of knowledge contained in presentation<br>[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 | DSP methods can be applied for metrology, to solve different issues. | [SW3] Assessment of knowledge contained in written work and projects |

## Subject contents

The principles of digital signal processing (nonuniform signal sampling), methods of spectral analysis (power psectral density estimation, higher spectra), stochastic resonans phenomena, Winer and Kalman filtering, linear and nonlinear adaptive filtering, methods of time-frequency analysis, methods of regression and detection using PCA and SVM algorithms, audio and video signals coding, DSL modem, multimedia apps in embedded systems - how to prepare.

## Prerequisites and co-requisites

Don't apply

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| test | 50.0% | 50.0% |
| seminar presentation | 0.0% | 50.0% |

## Recommended reading

| | |
|---|---|
| Basic literature | Haykin S.: Adaptive filter theory. Prentice Hall, 2001.<br><br>Zieliński T.P.: Cyfrowe przetwarzanie sygnałów. WKiŁ, Warszawa 2005.<br><br>Vaseghi S.V.: Advanced Digital Signal Processing. Wiley 2009. |
| Supplementary literature | Bilinskis I.: Digital alias2free signal processing. Wiley 2007. Haykin S.: Adaptive filter theory. Prentice Hall, 2001.<br><br>Kuo S.M., Gan W.S.: Digital signal processors 2 architectures, implementations and applications. Prentice Hall, 2005.<br><br>Chassaing R.: Digital signal processing and applications with the C6713 and C6416 DSK. Wiley 2005. |
| eResources addresses | Adresy na platformie eNauczanie:<br>Zaawansowane Przetwarzanie Sygnału - Moodle ID: 31981<br>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=31981 |

| | |
|---|---|
| Example issues/ example questions/ tasks being completed | nonuniform sampling<br>power spectra (parametric and nonparametric methods: ARMA, ME, Welch method)<br>polispectra (e.g., bispectrum)<br>stochastic resonance, applications<br>optimal linear filtering (Wiener, Kalman filtering)<br>algorithms of adaptive filtering<br>active noise reduction in headphones<br>ADSL modem<br>mp3 files coding<br>methods of time-frequency analysis(time-frequency resolution, time-varying filtering)<br>image denoising (wavelets, fractals, Savitzky-Golay smoothing, median filter, reduction of harmonic distortions)<br>algorithms of video coding (DCT, quantization, run-length coding, Huffman coding)<br>video transmission by Internet |
| Work placement | Not applicable |