



EUROPEAN UNION  
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Development and Education



Zdroj: <https://predmety.fbmi.cvut.cz/cs/doktorske-bme>

Name of study subject: **Biosignal processing and analysis**

**Brief annotation of the subject:**

The aim of the course is to introduce students to the basic principles of biosignal genesis, preprocessing, processing and visualization.

**Brief Syllabus of Lectures:**

1. Biopotential, stimulation and evoked biosignals. Electrical activity of the brain. Genesis of signals in the eye. Genesis of auditory system signals. Vestibular system signals.
2. Biosignals of skeletal muscles. Genesis of ECG curve. Polysomnography.
3. Sensing of electrical quantities. EEG, ECG, EMG, ERG, EGG.
4. Detection of non-electrical quantities. Image sensors, thermal imaging systems, RTG, imaging in nuclear medicine, ultrasound imaging systems.
5. Analogue filtration. A/D and D/A conversion. Sampling. Aliasing. Fourier transform.
6. Digital Filtering - FIR (Finite Impulse Response) filters. Window method.
7. Digital Filtering - IIR (Infinite Impulse Response) filters. Methods of design.
8. Spectral analysis. Spectral power density. Parametric and nonparametric methods. Periodogram and methods of its calculation. Mutual Spectrum, Coherence and Phase, Cordance. Spectral analysis and signal synthesis using FFT.
9. Digital image processing vs. computer vision. Digital image. Brightness histogram. Brightness transformation.
10. Spatial processing - morphological transformations, geometrical transformations.
11. Spatial processing - Fourier transform, convolution. Noise filtering and edge detection.
12. Spatial area processing - Segmentation of objects in the image.
13. Principles of MR imaging, spatial encoding, gradients, resolution, contrast, pulse sequence.
14. Methods of single and multidimensional data visualization.