**Signals and systems (ECTS credits: 6)**

Language: the course is offered in English, Serbian and Hungarian.

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**Course description:**

The course provides basic theoretical elements and typical mathematical methods of modeling and analysis of signals and systems. In addition to the theoretical aspect, the course also has a practical dimension. Through practical examples, the course explains the importance of theory.

This short course cover the following topics, considering the Signals and systems:

Course content:

1. General review, basic concepts of signal and system engineering. Classification of signals (continuous-time, discrete-time and continuous-value, discrete-value, deterministic and stochastic).
2. Some important continuous-time signal. Modification of the independent variable in case of continuous-time signal. The concept of convolution. Some important discrete-time signal. Modification of independent variable in case of discrete-time signal. Convolution of discrete-time signals.
3. Classification of systems. Properties of linear continuous-time systems. Continuous-time linear time invariant (LTI) systems. The n-th order constant coefficient differential equation in time domain (solution and application). Time constant and fundamental frequency. State space.
4. Sampling and hold circuit. Properties of linear discrete-time systems. Discrete-time LTI systems. Difference equations and their applications.
5. Fourier analysis of continuous time systems. The Fourier series, Fourier integral. The properties and application of Fourier transform. The Fourier transform from the aspect of sampling. Determination of frequency spectrum of sampled signal. The spectrum of reconstructed signal. The sampling theorem. The response of LTI system in frequency domain.
6. The Bode plot. Filtering of signals.
7. The Laplace transform and its properties. Inverse Laplace transform. Transfer function.
8. The z-transform and its inverse. The properties of z-transform. The impulse response function.
9. The discrete Fourier transform.
10. The properties of stochastic signals. Distribution function, density function. Expected value or first order momentum. Quadratic mean value, or second order momentum. Autocorrelation and autocovariance. Correlation and covariance. The Laplace and Fourier transform of correlation function. The relationship between the correlation function and frequency function.
11. The seminars are organized in general purpose computer rooms, using MATLAB, Signal Processing Toolbox, Simulink, and Control System Toolbox.

**Aims:**

The main goal of the course is to give a basic theory of mathematical methods of modeling and analysis of signals and systems. In addition to the theoretical aspect, the course also has a practical dimension. Through practical examples, the course explains the importance of theory.