FI:PA190 Digital Signal Processing
Student Evaluation

Study form

- Lectures
- Home works – not mandatory but rated

Exam form

The final exam consists of two parts – written and oral. Written part will contain theoretical questions and simple numeric examples. The written part form is not an "abc" test, meaningful answers are required followed by sketches etc., if needed.

Evaluation

Total points can be obtained four ways:

- Written exam part

  Maximum points: 40

- Oral exam part.

  Maximum points: 30

- Optional home works performed during the semester

  Maximum points: 30

- Extra (bonus) points awarded during semester.

90 points and more	…	A
80 to 89 points	…	B
70 to 79 points	…	C
60 to 69 points	…	D
50 to 59 points	…	E
0 to 49 points	…	F

FI:PA190 DSP Exam topics

The exam topics are based on the course content that is summarized in the presentations published on the subject share point:

1. Signal, spectrum. Continuous time signal concept, periodic signal and its representation using Fourier series, spectrum of rectangular signal. Spectral representation of non-periodic signal, Fourier transform.
2. Discrete time signal. Continuous time signal sampling, sampling theorem, aliasing. Signal discretization in values, analog-to-digital converter. Continuous time signal reconstruction from samples, digital-to-analog converter.
3. Digital signal processing principle. Linear time invariant (LTI) system. LTI system description in time domain, unit impulse response. Convolution and its properties, calculating system response using convolution. LTI systems commutativity.
4. LTI signal description by the means of signal flow diagram. Signal flow basic blocks. Using signal flow for LTI system response calculation. Finite signal response (FIR) system, infinite signal response (IIR) system, and their difference in the signal flow.
5. LTI system description in the operator domain. Z-transform, definition and properties, region of convergence. Z-transform of convolution, system transfer function. Signal flow diagram in operator domain. Mutual transition between transfer function and signal flow.
6. LTI system analysis in the frequency domain. Complex sinusoidal signal and its representation by a rotating phasor. LTI system frequency response, its polar representation, and properties. Real valued sinusoidal signal as an LTI system input.
7. Discrete time signal spectral analysis. Discrete time Fourier transform (DFTF) and its properties, inverse DTFT. Periodic discrete time signal and its spectral representation using discrete Fourier series (DFS). Incoherent sampling of a continuous time periodic signal. Discrete Fourier Transform (DFT), inverse DFT. DFT and DFS comparison.
8. Fast Fourier transform (FFT) and its main motivation. DFT matrix representation and Cooley – Tookey algorithm principle.
9. DFT/FFT typical usage. Spectrum estimation, FFT (DFT) calculated spectrum interpretation on frequency axis and on magnitude/phase axis. Sinusoidal signal DFT spectrum – coherent and incoherent sampling, leakage and its prevention using windowing. Increasing DFT resolution by the means of zero padding. Fourier filtering principle.
10. IIR filter design. Principle of filter design using an analog prototype, bilinear transform. IIR filter stability, frequency warping and pre-warping. Cascading filters.
11. FIR filter design. FIR filter symmetry, causality. Direct FIR filter design from the desired frequency response, the reasons for shifting the response and shortening the response by a window.