

Digital Signal Processing with MATLAB® (25 hours + 15 hours)

This training is about using MATLAB® Signal Processing toolbox for Bio-Medical signal processing, analysis, visualization, and algorithm development. The training covers various topics such as filter design, windowing techniques, transforms, multi-rate signal processing with respect to Bio-Medical Signals etc.

COURSE CONTENT :

Introduction to DSP (3 hours)

- Introduction to DSP
- Sampled data systems
- Aliasing and antialiasing
- Reconstruction
- Practical limitations
- Frequency & amplitude resolution
- Quantization and timing errors
- Correlation and convolution
- Frequency analysis
- Fourier transforms
- Frequency 'leakage'
- Windowing
- Multi-rate signal processing

Transforms (2 hours)

- Fourier Transform
- Z – Transform
- DCT Transform
- Wavelet Transform

Filters (5 hours)

- FIR Filter - FIR digital Filters
- FIR filter basics
 - Analysis of FIR filters
 - Frequency & impulse responses
 - The window design method
 - Optimization design methods
 - Practical limitations of FIR filters
- IIR Filter -
- IIR filter basics
 - Analysis of FIR filters
 - Frequency & impulse responses
 - IIR filter design
 - Poles, zeroes and filter response

DSP with MATLAB® (5 hours)

- Introduction to DSP Toolbox
- Signal processing functions in MATLAB® (conv, conv2, corrcoef, cov, cplxpair, deconv, fft, fft2, fftshift, filter2, freqspace, ifft, ifft2,unwrap)
- Time domain analysis of a signal

-
- Frequency domain analysis of a signal
-

**Digital Filter Design in
MATLAB®
(2 hours)**

- Discrete-Time Filters (Direct form I, Direct form II, lattice filters)
 - 1_D Median filtering
 - Butterworth filter design
 - Chebyshev Type I filter design (pass band ripple)
 - Chebyshev Type II filter design (stop band ripple)
 - Raised cosine FIR filter design
 - Recursive digital filter design
-

**Analog Filter Design in
MATLAB®
(2 hours)**

- Analog Low-pass Filter Prototypes
 - Analog Filter Transformation
 - Bi-linear transformation
 - Impulse-invariant Methods
 - Stabilizing a polynomial
 - Z-Transform partial fraction expansion
-

**Window Design
(2 hour)**

- Rectangular window
 - Hamming window
 - Hanning window
 - Bartlett window
 - Kaiser window etc
-

**Transforms
(2 hour)**

- Discrete fourier transform
 - Discrete cosine transform
 - Hilbert transform
 - Discrete wavelet transform
 - inverse transforms
-

**Multi-rate Signal
Processing
(2 hours)**

- Decimation
 - Interpolation
 - Up-Sampling
 - Down-Sampling
 - Re-Sampling
-

**Biomedical signal
processing
(15 hours)**

- Introduction to bio-medical signals
 - Signal acquisition
 - Signal analysis
 - Biomedical signal processing
 - Signal enhancement
 - Artifact removal
 - Hands-on on signal acquisition
 - Hands-on on iBiosaq / iMedilogger
-