

Introduction to Digital Signal Processing (DSP)

Course Syllabus Overview

Duration – 4 days

01. Introduction to DSP

- Roots of DSP
- Telecommunications
- Audio processing
- Echo location
- Image processing

02. Statistics, Probability, and Noise

- Signal and Graph Terminology
- Mean and Standard Deviation
- Normal Distribution

03. Analogue to Digital Conversion (ADC) and Digital to Analogue Conversion (DAC)

- Quantisation
- Sampling
- Digital-to-Analogue conversion

04. DSP Software

- Fixed point
- Floating point

05. Linear Systems

- Signals and systems
- Rules for naming signals
- Linear systems
- Shift invariance
- Static linearity
- Sinusoidal fidelity
- Special properties of linearity
- Synthesis and decomposition
- Superposition
- Common decompositions
- Impulse decomposition
- Step decomposition
- Even/odd decomposition
- Interlaced decomposition
- Fourier decomposition
- Treatment of nonlinearity

06. Convolution

- Delta function and impulse response
- Convolution
- Input side algorithm
- Output side algorithm
- Sum of weighted inputs

07. Properties of Convolution

- Delta function
- Calculus-like operations
- Low-pass and high-pass filters
- Causal and Noncausal signals
- Phase linearity
- Mathematical properties
- Correlation

08. Discrete Fourier Transform (DFT)

- Fourier transform categories
- Functions and transforms
- Notation and format
- Frequency domain's independent variable
- DFT basis functions
- Calculating inverse DFT
- Calculating DFT
- Calculating DFT by simultaneous equations
- Calculating DFT by correlation
- Calculating DFT by Fast Fourier Transform (FFT)
- Duality
- Polar notation
- Applications of the DFT

09. Continuous Introduction

- Delta function
- Convolution
- Fourier transform
- Fourier series

10. Introduction to Digital Filters

- Approaches to filtering problems
- Filter responses
- Filter implementation
- Step response
- Time and frequency domain responses
- Time domain parameters

- Frequency domain parameters, High-pass, band-pass, and band-reject filters
- Spectral inversion
- Spectral reversal
- Moving average filter
- Windowed-sinc filters
- Custom filters
- Overlap-add filters
- FFT convolution
- Recursive filters

11. Additional Information

- Further study
- Personal perspective

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