

Course Name: Advanced Digital Signal Processing

Course code: EE-620

Credits: 3-0-0-3 (Lectures-Assignments-Practicals-Total)

Prerequisites: Digital Signal Processing, Probability and Random Process, Mathematical Methods in Signal Processing

Elective/Core: Core subject for M.Tech. in Electrical Engineering with VLSI specialization)

Semester: Odd/Even

Preamble: This is a post-graduate level course in Digital Signal Processing. Starting with a review of continuous and discrete time systems, the course proceeds to time-frequency representation, wavelets, sparse representation and a typical application – compressive sensing. An upcoming area, deep learning is also included.

Course Outline:

- Fourier analysis
 - Time-frequency and wavelets.
 - Basis, frames and approximations in basis.
 - Applications – compressive sensing.
 - Deep learning.
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Modules:

1. Review of signals and systems: Linear time-invariant filtering, Fourier analysis, sampling, discrete time-invariant filters, DFT. (4 lectures)
2. Sub Nyquist sampling, multirate systems. (6 lectures)
3. Time-frequency atoms, windowed Fourier transform, wavelet transform (9 lectures)
4. Frames and Riesz basis. (9 lectures)
5. Linear and non-linear approximations in basis. (9 lectures)
6. Compressive Sensing (5 lectures)

Textbook

A Wavelet Tour of Signal Processing The Sparse Way, Stephen Mallat, Elsevier 2009

References

1. Foundations of Signal Processing, Vetterli M., Kovacevic J., Goyal V.K., Cambridge University Press, 2014.
2. Fourier and Wavelet Signal Processing, Vetterli M., Kovacevic J., Goyal V.K., Cambridge University Press, 2013.
3. Multirate Systems And Filter Banks, P.P. Vaidyanathan, Prentice Hall, 1993.
4. Current literature.