7^{th} Semester	REC7D003	Advanced Digital Signal Processing	L-T-P 3-0-0	3 CREDITS

Module-I: **(10 hours)**

Multirate Digital Signal Processing: Introduction, Decimation by a factor D, Interpolation bya factor I, Sampling rate Conversion by a rational factor I/D, Implementation of Samplingrate Conversion, Multistage implementation of Sampling rate Conversion, Sampling rateConversion of Band pass Signals, Sampling rate Conversion by an Arbitrary Factor, DigitalFilter Banks, Two-channel Quadrature Mirror Filter Bank.

Module-II: **(10 hours)**

Linear Prediction and Optimum Linear Filters: Random Signals, Correlation Functions, andPower Spectra, Innovation Representation of a Stationary Random Process, Forward andBackward Linear Prediction, Solution of the normal equations: The Levinson-DurbinAlgorithm. Properties of the Linear Prediction Error filters. Wiener filters for filtering andPrediction. Adaptive Filters: Applications of Adaptive filters, Adaptive Direct-Form FIR filters- The LMS Algorithm.

Module-III: **(10 hours)**

Power Spectrum Estimation: Estimation of Spectra from Finite Duration Observations ofSignals, Nonparametric Methods for Power Spectrum estimation, Relationship between theAutocorrelation and the model parameters. Bayes Theorem, Maximum Likelihooddetection.

Module-IV: **(10 hours)**

The Yule-Walker Method for the AR Model Parameters, The Burg Method for the AR modelParameters, Unconstrained Least-Squares Method for the AR model parameters, MA Modelfor Power Spectrum Estimation, ARMA model for Power Spectrum Estimation.

Books:

[1] Digital Signal Processing, John G.Proakis, Dimitris G. Manolakis, Pearson Education, New Delhi, 4th Edition, 2013.
[2] Adaptive Filter Theory, Simon Haykin, Pearson Education, 5th Edition 2017.
[3] Adaptive Signal Processing, Bernard Widrow, Samuel D Stearns, Pearson Education

Digital Learning Resources:

Course Name: Advance Digital Signal Processing
Course Link: https://nptel.ac.in/courses/117/101/117101001/
Course Instructor: Prof. V.M. Gadre, IIT Bombay