Course Code	Course Title	L	T	P	C
1152EC131	ADVANCED DIGITAL SIGNAL PROCESSING	2	2	0	3

a) Course Category

Program Elective

b) Preamble

Advanced digital signal processing courses includes theoretical and design aspects of multirate signal processing techniques. It includes spectrum estimation, linear prediction and adaptive filtering techniques. This course also introduces wavelet transform in signal processing applications

c) Prerequisite

Discrete Time Signal Processing.

d) Related Courses

DSP algorithms and architecture, Statistical Signal Processing

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Design of decimator, interpolator and FIR filter structure	K3
CO2	Explain the parametric and nonparametric power spectrum estimation techniques	K2
CO3	Explain the concepts of linear estimation and prediction of discrete time signals	K2
CO4	Describe the various adaptive filter algorithms	K2
CO5	Apply wavelet transform concept in signal processing	K3

f) Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	M	M	-	-	-	-	-	-	**L**	L	-
CO2	H	L	-	-	M	-	-	-	L	-	-	L	-	-
CO3	H	L	-	**L**	M	-	-	-	-	-	-	L	-	-
CO4	M	M	M	-	M	L	-	-	L	-	-	M	L	-
CO5	M	M	L	-	M	-	-	-	-	-	-	M	M	-

g) Course Content

UNIT I MULTIRATE DIGITAL SIGNAL PROCESSING 12

Introduction - sampling rate conversion by rational factor - Filter design and implementation for sampling rate conversion - Direct form FIR filter structures – Polyphase filter structure

UNIT II POWER SPECTRUM ESTIMATION 12

Parametric Methods for Power Spectrum Estimation: Relationship between Auto Correlation and Model Parameters - The Yule Walker method for the AR model parameters - the Burg method for the AR model parameters. Non-Parametric Methods: Bartlett - Welch and Blackman -Tukey method - Model based approach – AR – MA - ARMA Signal modeling.

UNIT III LINEAR ESTIMATION AND PREDICTION 12

Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Forward and backward linear prediction - Prediction error - Levinson recursion algorithm for solving Toeplitz system of equations.

UNIT IV ADAPTIVE FILTERS 12

FIR Adaptive filters - Adaptive filters based on steepest descent method - LMS Adaptive algorithm - Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation - Adaptive recursive filters - Recursive least squares

UNIT V INTRODUCTION TO WAVELET TRANSFORMS 12

Short Time Fourier Transform - Wavelet Transform: Continuous Wavelet Transform- Wavelet Transform Ideal Case - Haar Wavelet – Daubechies Wavelet - Applications to sub band coding - Wavelet transform and filter bank implementation.

Total 60 Hrs

h) Learning Resources

Text Books

1. John G. Proakis and Dimitris rd G. Manolkis, “Digital Signal Processing, Principles, Algorithms and Applications”, 3 edition, Prentice Hall of India, 2001.
2. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling”, Wiley, 2002.

Reference Books

1. S.Haykin, “Adaptive Filter Theory”, 2nd Edition, Prentice Hall, 2001
2. Roberto Crist, “Modern Digital Signal Processing”, Thomson Brooks/ Cole, 2004.
3. Raghuveer. M. Rao and AjitS.Bopardikar, “Wavelet Transforms: Introduction to Theory and Applications”, Pearson Education, Asia, 2000.
4. S.Haykin, “Adaptive Filter Theory”, 2nd Edition, Prentice Hall, 2001

Online Resources

1. www.redcedar.com/**resources**.htm
2. eleceng.dit.ie/dorran/moodle/
3. ocw.mit.edu › Supplemental Resources
4. www.ifp.illinois.edu/~minhdo/teaching/wavelets.html