Reg. No. : | | | | | | | | | | |

Question Paper Code: 12022

M.E. DEGREE EXAMINATION, DECEMBER 2013.

First Semester

Communication Systems

01PCM101 - ADVANCED DIGITAL SIGNAL PROCESSING

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. State Wiener-Khintchine relation.
2. Write the expression for the Power Spectrum of ARMA (p,q) process.
3. Mention the criterions used for comparing the performance of the spectral estimation.
4. Comment on the advantages of Maximum entropy method.
5. Define multistep prediction.
6. Define Kalman gain and mention its significance.
7. State the condition for convergence in LMS algorithm.
8. Mention the need for channel equalization.
9. Justify the need for Polyphase structures in Multirate signal processing.
10. What is subband coding? Give its application to signal processing.

PART - B (5 x 14 = 70 Marks)

11. (a) (i) State and explain the properties of Autocorrelation sequence of WSS process. (8)

(ii) Consider ARMA process generated by the difference equation

$x(n) = 1.6x(n-1) – 0.63x(n-2) + w(n) + 0.9w(n-1)$

Determine the system function of the whitening filter and power density spectrum of $x(n)$. (6)

Or

(b) (i) Explain MA and ARMA processes. (6)

(ii) Consider a first order AR process that is generated by the difference equation $y(n) = ay(n-1) + w(n)$ where $|a| < 1$ and $w(n)$ is zero mean white noise random process with variance $\sigma^2_{w.}$

Find the unit sample response of the filter that generates $y(n)$ from $w(n)$ and the autocorrelation of $y(n)$. (8)

12. (a) Derive the expressions for the mean, variance and resolution for Blackman – Tukey method of Periodogram smoothing. Comment on the values. (14)

Or

(b) Explain any one of the parametric method of power spectral estimation with necessary performance measures. (14)

13. (a) Explain the Maximum Phase and Orthogonality property of backward prediction error filters with necessary expressions. (14)

Or

(b) Describe optimum IIR Wiener filter and obtain the expression for MMSE. (14)

14. (a) Discuss the difference between Steepest descent and LMS algorithm. Derive the Weight updation equation of LMS Adaptive filter. (14)

Or

(b) (i) Explain how the echo cancellation is done with adaptive filters. (8)

(ii) Discuss on mean square error in RLS algorithm. (6)

15. (a) (i) Obtain the Polyphase structure of the filter with the transfer function $H(Z) = 1-3Z^{-1}/1+4Z^{-1}$. (8)

(ii) Explain the ideal characteristics of Decimation filters in frequency domain. (6)

Or

(b) Explain the design procedure of multistage decimators and interpolators with necessary diagrams. (14)

PART - C (1 x 10 = 10 Marks)

16. (a) Describe Levinson – Durbin algorithm for spectrum estimation in detail. (10)

Or

(b) Explain Wavelet transform and its application in signal processing. (10)