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

Question Paper Code: 52121

M.E. DEGREE EXAMINATION, DECEMBER 2015

First Semester

Communication Systems

15PCM101 - ADAPTIVE SIGNAL PROCESSING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. Parseval's theorem for energy signals is also called

   (a) Parseval's power theorem (b) Bessel theorem
   (c) Rayleigh energy theorem (d) Schwarz theorem

2. The quality factor of Bartlett power spectrum estimate is

   (a) 1.29 $N\Delta f$ (b) 2.34 $N\Delta f$ (c) 1.11 $N\Delta f$ (d) 0.78 $N\Delta f$

3. Wiener filter is a

   (a) Adaptive filter (b) Linear filter
   (c) Both (a) and (b) (d) Non-linear filter

4. The algorithm aim to reduce the mean square error is

   (a) RLS algorithm (b) LMS algorithm
   (c) Both (a) and (b) (d) None of the above

5. To avoid aliasing, the sampling rate for the band pass signal should be

   (a) $F_s \geq 2B$ (b) $F_s \leq 4B$ (c) $F_s \leq 2B$ (d) $2B \leq F_s \leq 4B$

PART - B (5 x 3 = 15 Marks)

6. Define statistical variance and covariance.

7. What is the basic principle of Welch method to estimate power spectrum?

8. Compare IIR and FIR Wiener filters.

9. Write the difference between LMS algorithm and RLS algorithm.

10. What is meant by image smoothing and image sharpening?

PART - C (5 x 16 = 80 Marks)

11. (a) State and prove Wiener-Khitchine relation. (16)

Or

(b) Consider the ARMA process generated by the difference equation,
x(n) = 1.6 x(n-1) - 0.63 x(n-2) + w(n) + 0.9 w(n-1).

(i) Determine the system function of the whitening filter and its poles and zeroes

(ii) Determine the power density spectrum of *x(n).* (16)

12. (a) Derive the variance of the periodogram using Blackman-Tukey method. (16)

Or

(b) How the solution for normal equations is obtained using Levinson-Durbin algorithms. (16)

13. (a) Explain how FIR Wiener filter can be used for filtering and prediction. (16)

Or

(b) Give a detailed account of linear prediction. (16)

14. (a) Obtain Widrow-Hoff LMS adaptation algorithm. (16)

Or

(b) Explain in detail about

(i) Adaptive echo cancellation (8)

(ii) Adaptive noise cancellation. (8)

15. (a) Explain the need for multistage implementation of sampling rate conversion. Describe the implementation for a factor of non integer factor. (16)

Or

(b) Explain in detail about interpolation by a factor I. (16)

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