B.E. DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2011
ELECTRONICS AND COMMUNICATION ENGINEERING
SEVENTH SEMESTER – (REGULATIONS 2008)
EC 9037 ADVANCED DIGITAL SIGNAL PROCESSING

Time: 3 hrs Max. Marks: 100

Answer ALL Questions

Part– A (10 x 2 = 20 Marks)

1. What are the conditions for two random process x(n) and y(n) to be (i) uncorrelated (ii) orthogonal?

2. Show that $P_x(e^{j\omega}) \geq 0$.

3. Define bias and consistency of an estimate?

4. Determine the % offset or % overlap in Welch's power spectral estimation given the number of points as 512, Section length = 128, number of sections = 13.

5. What is orthogonality principle in Wiener filtering?

6. Write the Wiener-Hopf equations for non-causal and causal IIR Wiener filters.

7. Determine the range for the step size (μ) in LMS algorithm by considering the eigen values of 2 x 2 autocorrelaion matrix, R_x = [4 1 ; 1 4].

8. What is the advantage of an adaptive filter?

9. If $\phi(x)=\begin{cases}1 & ,0\leq x\langle 1\\ 0 & ,otherwise\end{cases}$, express $\phi_{0,1}(x)$ in terms of functions in subspace V_1.

10. How is LL band computed for an image using 2-D wavelet transform?

(PTO)

Part- B (5 x 16 = 80 Marks)

11. (a) Write the refinement equation and state its meaning. (4)

(b)Derive the necessary expressions for Fast Wavelet transform and draw the scheme for obtaining approximation and detail coefficients from j+1 resolution to resolution j. (12)

12(a). (i) Discuss first and second-order stationarities. (6)

(ii) Determine the autocorrelation sequence corresponding to (10)

$$P_x(z)=\frac{-2z^2+5z-2}{3z^2+10z+3}.$$

OR

12(b). Derive Yule-Walker equations for ARMA process.

13(a). Discuss Bartlett's method of power spectrum estimation and its bias and variance.

OR

13(b). Derive a 3rd order all-pole model for the signal having $r_x(0) = 1$, $r_x(1) = 0.8$, $r_x(2) = 0.5$, $r_x(3) = 0.1$ using Levinson recursion.

14(a). Design a Wiener filter with filter coefficients w(0), w(1) and w(2) for estimating d(n) from x(n)=d(n)+v(n) where d(n) is an AR(1) process generated as d(n) = 0.5 d(n-1)+w(n) where $\sigma_w^2 = 1$ and $\sigma_v^2 = 1$.

OR

14(b). Design a causal wiener filter H(z) and its impulse response for estimating d(n) in x(n)=d(n)+v(n) where d(n) is an AR(1) process generated as d(n) = 0.6 d(n-1)+w(n) where $r_w(k) = 0.8\delta(k)$ and $r_v(k) = \delta(k)$.

15(a). Derive the range for the step size (μ) in LMS algorithm.

OR

15(b). (i) Derive the weight update equations in LMS algorithm starting from steepest descent. (10)

(ii) Discuss the computational requirements in LMS algorithm. (6)

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