

Register Number:

B.E DEGREE EXAMINATIONS: MAY/JUNE 2013

Seventh Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE128: Advanced Digital Signal Processing

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If the bias of an estimate goes to zero as the number of observations goes to infinity, the estimate is :
 - a) unbiased
 - b) biased
 - c) asymptotically unbiased
 - d) consistent
2. The power spectral density of white noise is equal to :
 - a) variance
 - b) autocorrelation
 - c) unit impulse
 - d) periodogram
3. If $x(n)$ is predicted using the value of $x(n+5)$ it is :
 - a) forward linear prediction
 - b) linear prediction
 - c) backward linear prediction
 - d) optimum prediction
4. The optimum filter that produces the best estimate of the desired signal is :
 - a) noncausal
 - b) causal
 - c) stable
 - d) unstable
5. The design of adaptive filters is based on the following equation:
 - a) $R_x w = r_{dx}$
 - b) $w_{n+1} = w_n + \Delta w_n$
 - c) $\lim_{n \rightarrow \infty} w_n = R_x^{-1} r_{dx}$
 - d) $\hat{d}(n) = \sum_{k=0}^p w_n(k) x(n-k)$
6. In the steepest descent adaptive filter, the step size is limited by:
 - a) $\frac{1}{\lambda_{\max}}$
 - b) $\frac{2}{\lambda_{\max}}$
 - c) λ_{\max}
 - d) 1
7. Insertion of zero valued samples in a discrete signal leads to :
 - a) change in sampling rate
 - b) decimation
 - c) change in the frequency
 - d) Interpolation

8. The filters used in multirate signal processing are:
 - a) IIR
 - b) polyphase
 - c) FIR
 - d) stable
9. Fourier transform of a signal taken in a time window is called:
 - a) wavelet transform
 - b) discrete Fourier transform
 - c) continuous Fourier transform
 - d) short-time Fourier transform
10. Compression of a signal can be achieved using :
 - a) subband coding
 - b) wavelet transform
 - c) sampling and encoding
 - d) MRA

PART B (10 x 2 = 20 Marks)

11. Show that the periodogram is not a consistent estimate of power spectrum.
12. What is the necessity for periodogram smoothing?
13. State the orthogonality principle for noncausal IIR Wiener filter.
14. What are the constraints on the signals in the design of Wiener filter for prediction?
15. Define gradient.
16. What is normalized LMS algorithm?
17. If two samples are removed from a signal for every five samples, what is the change in the sampling rate?
18. What is canonical form of filter implementation?
19. State the MRA equation for scaling and wavelet functions.
20. What are the methods of implementing wavelet transform?

PART C (5 x 14 = 70 Marks)

21. a) (i) Describe ARMA, AR and MA processes. (6)
 (ii) Prove the properties of Bartlett method of spectrum estimation. (8)
 (OR)
 b) (i) What is parametric spectral estimation? (4)
 (ii) Find the third order all-pole model for a signal having autocorrelation values: (10)
 $r_x(0) = 1, r_x(1) = 0.5, r_x(2) = 0.5, r_x(3) = 0.25$
22. a) (i) Derive the Wiener-Hopf equations for FIR Wiener filter. (8)
 (ii) Design a first order FIR Wiener filter to estimate $d(n)$ in the presence of noise $v(n)$ with variance σ_v^2 . The autocorrelation of $d(n)$ is given by $r_d(k) = \alpha^{|k|}$ (6)
 (OR)
 b) Derive the necessary equations in designing a discrete Kalman filter for estimation of nonstationary processes.

23. a) (i) Derive the Weiner-Hopf equations for FIR adaptive filter. (10)
(ii) What is normalized LMS? Explain briefly. (4)

(OR)

- b) (i) Explain the principle of RLS algorithm. (4)
(ii) Explain how channel equalization and noise cancellation is done using adaptive filters. (10)

24. a) (i) Explain the principle of interpolation with necessary diagrams. (7)
(ii) Illustrate the frequency domain characterization of the above. (7)

(OR)

- b) (i) With illustrations, explain how a decimator is implemented using polyphase decomposition. (6)
(ii) Show that a multistage implementation of decimation / interpolation is more efficient than single stage implementation. (8)

25. a) (i) What is multiresolution analysis of a signal? Explain with an example. (10)
(ii) Compare Fourier transform, short-time Fourier transform and wavelet transform. (4)

(OR)

- b) (i) Describe the continuous wavelet transform and prove any two of its properties. (10)
(ii) Explain how Haar wavelets are used in multiresolution analysis. (4)
