Register No: ……..

B.E DEGEREE EXAMINATIONS: APRIL/MAY 2011

Sixth Semester

ELECTRONICS COMMUNICATION ENGINEERING

U07ECE02: Advanced Digital Signal Processing

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Autocorrelation function $R_X(\tau)$ is

A)Even function B) Odd function C) $R_X(\tau) < R_X(0)$ D)A&C are correct

2. A random process x(t) is called wide sense stationary if

A) First order moment is constant B) Second order moment is constant

C) Autocorrelation function is independent of time D) All the above

3. FIR filter is also known as

A) Cascade structure filter B) Transversal filter C) ARMA filter D) AR filter

4. If the impulse response of a system is over a finite duration, then it is

A) a Moving average system B) an Auto regressive system

C) an ARMA system D) an IIR system

5. What do we call the manipulation of an analog signal in a digital domain?

A) Analog-to-digital conversion B) Digital-to-analog conversion

C) Digital signal processing D) Signal filtering

6. What is the result of taking more samples during the quantization process?

A) More errors in the analog-to-digital conversion

B) More bit requirements

C) More accurate signal representation

D) More bit requirements and more accurate signal representation

7. Speech organs are divided into

A) The lungs B) The larynx C) Vocal tract D) All the above

8. The pitch fundamental frequency of a female is

A) 60Hz B) 400Hz C) 3.4KHz D) 4KHz

9. The mother wavelet $\psi(t)$ is given by

A) $\int \psi(t)\, dt = 0$ B) $\int \Phi(t)\, dt = 0$ C) $\int \Phi(t)\, dt = x$ D) $\int \psi(t)\, dt = 1$

10. Examples for Non-orthognal wavelet are

A) Morlet & Mexican hat B) Daubechies & Haar

C) B-spline & V-spline D) Coiflets & symmlats

PART B (10 x 2 = 20 Marks)

11. Compare AR, MA and ARMA models with respect to complexity.
12. What are the performance measures for the peroidogram based spectrum estimation technique?
13. What is the weight vector update equation of LMS algorithm?
14. What are the properties of Adaptive Filters?
15. What is the need for Low Pass Filter in a decimator?
16. Give an important advantage of multi-rate DSP systems.
17. What are the categorizations of sound by source?
18. Define Fricatives
19. What are the advantages of wavelet transforms?
20. Write the equation for Gabor transform.

PART C (5 x 14 = 70 Marks)

21. a) Suppose we are given a linear shift-invariant system having a system function $H(z) = (1 - (z^{-1}/2)) / (1 - (z^{-1}/3))$ that is excited by zero mean exponentially correlated noise x(n) with an autocorrelation sequence $r_x(k) = (0.5)^{|k|}$ Let y(n) be the output process, y(n) = x(n) * h(n).

(i) Find the power spectrum $P_y(z)$, of y(n). (4)

(ii) Find the autocorrelation sequence $r_y(k)$ of y(n) (5)

(iii) Find the cross-correlation $r_{xy}(k)$ between x(n) and y(n). (5)

(OR)

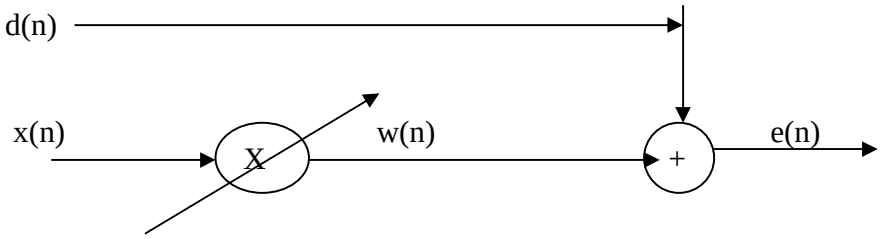
b) (i) Compare Parametric and non-parametric estimators. (4)

(ii) Derive the Yule-Walker equations for ARMA model (10)

22. a) With analytical expression, describe the weight adjustment algorithm using the method of steepest decent and also derive the condition for convergence.

(OR)

b) Consider the single weight adaptive filter shown in the figure below

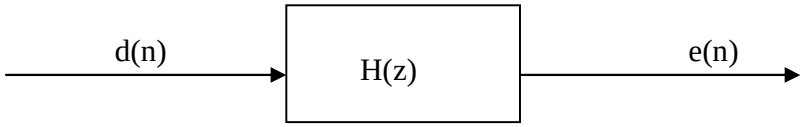


(i) Write down the LMS algorithm for updating the weight w (4)

(ii) Suppose that x(n) is a constant (10)

$$x(n) = \begin{cases} K & n \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Find the system function relating d(n) to e(n) using the LMS algorithm i.e., find H(z) in the figure below



23. a) (i) Discuss the effect of down sampler in frequency domain (7)

(ii) Mention some application of multi-rate signal processing (7)

(OR)

b) Consider a decimator with down sampling factor 3 and a 12^{th} order filter. After deriving necessary equations, draw the structure of the decimator with the derived poly phase filters.

24. a) With an example explain the mechanism of speech production model.

(OR)

b) Derive the equation for Levinson-Durbin recursive method for Linear Predictive coding.

25. a) Write a short notes

(i) Haar Wavelet (7)

(ii) Daubechies Wavelet (7)

(OR)

b) With expression discuss wavelet transform and filter bank implementation.

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