Register Number: ………………….

M.E. DEGREE EXAMINATIONS: JANUARY 2011

First Semester

ANE503: ADVANCED DIGITAL SIGNAL PROCESSING

(Common to Communication Systems and Applied Electronics)

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

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. Define energy and power of discrete signals?
2. State the spectral factorization theorem.
3. What is periodogram?
4. What are the types of stochastic models?
5. Distinguish between forward and backward linear prediction.
6. How is the Kalman filter different from Wiener filter in estimation?
7. What is the basic difference between LMS and RLS filters?
8. What is the need for channel equalization?
9. What do you mean by polyphase realization?
10. What is the need for anti-imaging filter in up-sampler?

PART B (5 x 16 = 80 Marks)

11. a) (i) State and prove Wiener Khintchine relation. (8)

(ii) The power spectrum of a WSS process x(n) is $P_{xx}(e^{j\omega}) = \frac{25-24\cos\omega}{26-10\cos\omega}$. Find the whitening filter H(Z) that produces unit variance white noise when the input is x(n).(8)

(OR)

b) (i) Derive the relation between the input and output Power Spectral Densities when a random signal is the input to a LTI filter. (8)

(ii) If x(n) is a random process generated by filtering white noise w(n) having unity variance with a I^{st} order LSI filter having a system transfer function H(Z) = $\frac{1}{1-0.25Z^{-1}}$, then find the power spectrum and the autocorrelation of x(n). (8)

12. a) (i) Explain the Welch method of power spectrum estimation. (8)

(ii) Compare the performance of non-parametric power spectrum estimators. (8)

(OR)

b) (i) What are the steps involved in parametric power spectrum estimation. List the parametric models with appropriate difference equations. (8)

(ii) Derive the appropriate equations and discuss the Yule-Walker method of power spectrum estimation. (8)

13. a) Describe the Levinson-Durbin recursion algorithm for solving Linear Symmetric Toeplitz equations.

(OR)

b) (i) Obtain the Wiener Hopf equations of a FIR Wiener filter. (8)

(ii) Design a first order wiener filter to reduce the noise in x(n) and obtain a desired signal d(n) whose autocorrelation sequence is given by $r_{dd}(k) = \alpha^{|k|}$ with $0<\alpha<1$, and the desired signal is observed in the presence of uncorrelated white noise v(n) with variance σ_v^2. (8)

14. a) What is the practical limitation of the steepest decent adaptive filter and how is it overcome in LMS algorithm? Discuss about the convergence of the LMS algorithm.

(OR)

b) Derive a recursive solution for exponentially weighted RLS algorithm with appropriate initialization and discuss.

15. a) (i) Explain the process of decimation by an integer factor with any specific spectral shape. (8)

(ii) Discuss in detail about polyphase realization. (8)

(OR)

b) (i) Write a short note on wavelet transform. (8)

(ii) Explain the filter bank implementation of wavelet expansion of signals. (8)

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