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Roll No .....

MEMT-204

M.E./M.Tech., II Semester

Examination, June 2017

Theory of Random Signal

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Explain central limit theorem and give its significance.
   b) Write the characteristics of binomial probability distribution function.

2. a) Let X be a continuous random variable with uniform pdf in (0.2π). Find the probability density function of $y = \cos x$
   b) The random variable X is of continuous type, we form the random variable $y = g(x)$. Find $f_y(x)$ of $g(x) = 2f_x(x)+4$.

3. a) Explain non-stationary process.
   b) Show that the process $x(f) = c\omega(f)$ is WSS iff $E\{c\} = 0$ and $\omega(f) = e^{j(\omega+\theta)}$

4. Write short notes on :
   a) Ergodicity
   b) Harmonic analysis

5. a) Explain Weiner filter for filtering of prediction.

   b) Determine the optimum causal IIR Wiener filter for the signal $x(n) = s(n) + w(n)$, where $s(n)$ is an AR(1) process that satisfy the difference equation.
   $s(n) = 0.8s(n-1) + v(n)$
   Where $\{v(n)\}$ is a white noise sequence with variable $\sigma_u^2 = 0.49$ and $\{w(n)\}$ is a white noise sequence with variance $\sigma_u^2 = 1$. The processes $|u(n)|$ and $\{w(n)\}$ are uncorrelated.

6. a) State and prove minimum phase property of the backward prediction-error filter.
   b) The power density spectrum of an AR process $\{x(n)\}$ is given as $\Gamma_{xx}(\omega) = \dfrac{\sigma_u^2}{|A(\omega)|^2} = \dfrac{25}{\left|1 - e^{-j\omega} + \dfrac{1}{2}e^{-j2\omega}\right|^2}$

   where σ_u^2 is the variance of the input sequence. Determine the system function for the Wintering filter.

7. a) Give estimation of autocorrelation of random signals.
   b) Determine the mean and autocorrelation of the sequence $x(n)$, which is the output of a ARMA (1, 1) process described by the difference equation

$$x(n) = \frac{1}{2}x(n-1) + w(n) - w(n-1)$$

   where $w(n)$ is a white noise process with variances σ_u^2.

8. Write short note on :
   a) Periodogram
   b) Parametric method

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