Code No: RR210404 **RR**

II B.Tech I Semester(RR) Supplementary Examinations, May/June 2010
SIGNALS AND SYSTEMS
(Common to Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Write the significance of spectral analysis in communication systems. [4M]
   (b) Explain how a function can be approximated by a set of orthogonal functions. [6M]
   (c) Derive the expression by which the Mean square error can be evaluated. [6M]

2. With regard to Fourier series representation, justify the following statement.
   (a) Odd functions have only sine terms. [5M]
   (b) Even functions have no sine terms. [5M]
   (c) Functions with half-wave symmetry have only odd harmonics. [6M]

3. (a) State and prove convolution and differentiation properties of Fourier Transforms. [3+3+4=10M]
   (b) A signal x(t) is given as x(t)=6 cos 10 πt. This signal is sampled by an impulse train. The sampling frequency of the impulse train are 7 Hz and 14 Hz. Draw the spectra of the original signal. Draw the spectra of the sampled signal with sampling frequency 7 Hz and 14 Hz. [6M]

4. (a) Explain the difference between a time invariant system and time variant system? Write some practical cases where you can find the systems. What do you understand by the filter characteristics of a linear system? Explain the condition of causality? [2+2+4+2=10M]
   (b) What is the effect of under sampling? [6M]

5. (a) Energies of signals g_1(t) and g_2(t) are Eg_1 and Eg_2, respectively. [3M]
      i. Show that in general, the energy of signal $g_1(t) + g_2(t)$ is not $Eg_1 + Eg_2$. [3M]
      ii. Under what condition is the energy of $g_1(t) + g_2(t)$ equal to $Eg_1 + Eg_2$. [3M]
      iii. Can the energy of the signal $g_1(t)+g_2(t)$ be zero? If so under what condition? [2M]
   (b) State and prove Rayleigh's energy theorem. [2+6=8M]

6. (a) Let $R_{12}(\lambda)$ and $R_{21}(\lambda)$ denote the cross correlate function of two energy signals g_1(t) and g_2(t). Show that the total area under $R_{12}(\lambda)$ is defined by
   $\int_{-\infty}^{\infty} R_{12}(\tau)d\tau = [\int_{-\infty}^{\infty} g_1(t)dt][\int_{-\infty}^{\infty} g_2(t)dt]^*$. [8M]
   (b) Show that $R_{12}(\lambda)=R_{21}^*(-\lambda)$. [8M]

7. (a) Use geometric evaluation from the pole-zero plot to determine the magnitude of the Fourier transform of the signal whose Laplace transform is specified as $X(s) = \frac{s^2-s+1}{s^2+s+1}$ $\Re$ e{s} > -(1/2). [6+2=8M]
   (b) Determine the Laplace transform and associated region of convergence
   And pole-zero plot for the following function of time $x(t)=e^{-2t}u(t)+e^{-3t}u(t)$. [6+2=8M]

8. (a) Find the inverse z transform of X (z) using power series method, given
   $X(z)=1/[1-az^{-1}], |z| < |a|$. [8M]
   (b) Prove that for causal sequences the R.O.C in exterior of circle of some radius 'r'. [8M]

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