Code No: OR210453 **OR**

II B.Tech I Semester Supplementary Examinations, May 2005
SIGNALS & SYSTEMS
(Electronics & Communication Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the importance of signal analysis with respect to communication systems and Network analysis.
   (b) Differentiate Orthogonal signal space and Orthonormal signal spaces. Discuss clearly their application with regard to representing a unknown time varying signal.
   (c) Derive the condition for orthogonality between two complex signals $f_1(t)$ and $f_2(t)$

2. (a) Find the Fourier series for the periodic signal shown below the figure1:

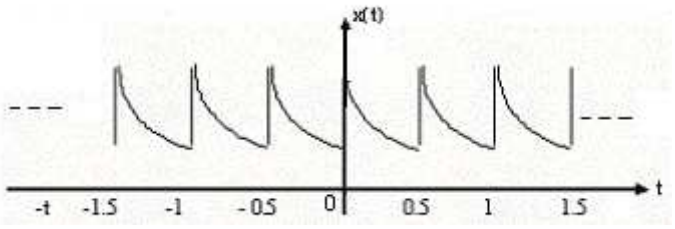

Figure 1:

   (b) With regard to Fourier series representation, justify the following statements:
      i. Odd functions have only sine terms
      ii. Even functions have no sine terms
      iii. Functions with half wave symmetry have only odd harmonics.

3. (a) Determine the Fourier transform of a two sided exponential pulse x (t) = $e^{-|t|}$
   (b) Find the Fourier transforms of an even function $x_e(t)$ and odd function $x_o(t)$ of x(t).

4. (a) The transfer function of an ideal bandpass filter is given by
   $H(jw)= k[G_w(w-w_o)+G_w(w+w_o)]\exp(-jwt_o)$.
   Sketch the magnitude and phase function of this transfer function. Evaluate the impulse response of this filter. Sketch this response and state whether the filter is physically realizable
   (b) Derive an expression for the transfer function of an LTI system.

5. (a) A power signal g(t) has a PSD $S_g(\omega) = N/(A^2)$ $-2\pi B \leq \omega \leq 2\pi B$., shown in the figure2. Where A and N are constants. Determine the PSD and the mean square value of its derivative d(g(t)/dt.

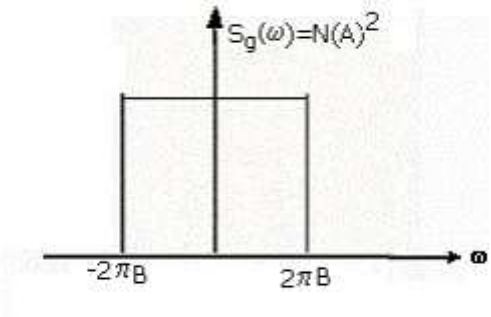

Figure 2:

(b) Derive the relation between power and power density spectrum.

6. Determine the cross correlation function $R_{12}(\lambda)$ of two signals $g_1(t)$ and $g_2(t)$ defined by
$g_1(t) = \begin{cases} ACos(2\pi f_1 t + \theta_1), 0 \le t \le T \\ 0, \quad elsewhere \end{cases}$ $g_2(t) = \begin{cases} ACos(2\pi f_2 t + \theta_2), 0 \le t \le T \\ 0, \quad elsewhere \end{cases}$
How does varying the frequency difference $|f_1\text{-}f_2|$ affect this cross-correlation function?

7. (a) Show the Laplace transform of $x(t)=e^{-at}\left[A\cos bt + \left(\frac{B-Aa}{b}\right)\sin bt\right].u(t)\, is\, X(s) = \frac{As+B}{(s^2+2as+c)}$ where $c=b^2+a^2$ and $a>0$.

(b) State and prove time-differentiation property of one-sided Laplace transform.

8. (a) State and prove the convolution and scale change properties in z transform.

(b) Prove that the final value of x (n) for X (z) = $z^2/[z\text{-}1][z\text{-}0.2]$ is 1.25 and its initial value is unity.

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