Code No: OR221052 **OR**

II B.Tech II Semester Supplementary Examinations, April/May 2005
SIGNALS & SYSTEMS
(Common to Electronics & Instrumentation Engineering and Electronics & Control Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the significance of spectrum analysis of signal with regard to synthesis of systems.
   (b) Define orthogonal signal space and bring out clearly its application in representing a signal.
   (c) Obtain the condition under which two signals $f_1(t)$ and $f_2(t)$ are said to be orthogonal to each other. Hence prove that Sin nwot and Cos mwot are orthogonal to each other for all integer values of m,n.

2. The complex exponential representation of a signal f(t) over the interval (0,T) is

$$f(t) = \sum_{n=-\alpha}^{\alpha} (3/4 + (n\pi)^2) e^{jnxt}$$

   (a) What is the numerical value of T ?
   (b) One of the components of f(t) is A Cos3π t. Determine the value of A.
   (c) Determine the minimum number of terms which must be retained in the representation of f(t) in order to include 99.9% of the energy in the interval.

3. (a) Find the Fourier transform of the following function.
      i. x(t)= Sin ((2 π $f_o t$).
      ii. x(t)=A rect(t/c) Cos (2 π $f_c t$).
   (b) State and prove differentiation and integration properties of Fourier transform.

4. (a) Discuss the causality and stability properties of LTI systems.
   (b) An LTI system described by

$$y(t) = \frac{1}{T} \int_{t-\frac{T}{2}}^{t+\frac{T}{2}} x(\lambda) d\lambda$$

      i. Find and sketch impulse response of the system.
      ii. Is this system causal.

5. Consider a gaussian filter H

$$\exp(-k\omega^2 + j\omega t_0)$$

.

(a) Determine and sketch the unit impulse response of this filter.

(b) State, with reasons, whether this filter is physically realizable.

(c) Can this filter be made approximately realizable by providing a sufficient amount of delay t_0?

6. (a) Specify two distinctly different pulse signals that have exactly the same auto correlation function.

(b) Consider a signal g(t) given by $g(t) = A_0 + A_1 Cos(2\pi f_1 t + \theta) + A_2 Cos(2\pi f_2 t + \theta)$.

i. Determine the auto correlation function $R(\ \tau\ )$ of this signal.

ii. What is the value of R(0).

iii. Has any information about g(t) been lost in obtaining auto correlation function?

7. (a) Invert the following Laplace transform and compute its initial and final values, if possible: X(s)=

$$\frac{s^3 + 3s^2 + 3s + 1}{(s^4 + 4s^3 + 6s^2 + 4s + 1)}$$

(b) Find the frequency response of X(s)=

$$\frac{(s+2)}{(s+1)(s+5)}$$

and plot its spectrum.

8. (a) Given X (z) = z / [z-1] ^3 , find x (n) using contour integration method

(b) Distinguish between one-sided and two sided z-transforms. What are this applications.

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