Code No: C6105, C6505 **NR**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I Semester Examinations October/November-2011
DETECTION & ESTIMATION THEORY
(COMMON TO COMMUNICATION SYSTEMS, WIRELESS & MOBILE COMMUNICATIONS)

Time: 3hours **Max.Marks:60**

Answer any five questions
All questions carry equal marks
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1. a) We are given k independent observations:

$$H_1: Z_k = V_k \qquad k = 1,2,\dots\dots K$$
$$H_0: Z_k = 1 + V_k \qquad k = 1,2,\dots\dots K$$

Where V_k is zero-mean Gaussian random variable with variance σ^2. Compute the likelihood ratio and the threshold for the optimum receiver. Assume that $C_{00}=C_{11}=0$, $C_{01}=2$, $C_{10}=1$ and that $P(H_0)=0.7$, $P(H_1)=0.3$.

b) Explain how Multiple hypothesis testing can be decide which of the ouputs is the correct one? [12]

2. a) What is mean by spectral decomposition and explain it with suitable example.

b) Explain the significance of performance Bounds in signal estimation. [12]

3.a) Design a filter that maximizes the output signal-to-noise ratio when the transmitted signal y(t) is observed in additive white noise of spectral density No/2. The signal y(t) is given by

$$y(t) = \begin{cases} e^{-\frac{t}{2}} - e^{-t} & t \geq 0 \\ 0 & t \leq 0 \end{cases}$$

What is the maximum output SNR?

b) Compare the linear and non-linear estimates. [12]

4. Define the following terms with respect to estimators:

(a) Bias (b) efficiency (c) sensitivity (d) uniform cost function [12]

5. a) Obtain MMSE estimate of x_1 from the observation $Z=X_1+X_2$ where X_1 and X_2 are independent and are Rayleigh distributed with parameters σ_1^2 and σ_2^2 .

b) What type of estimate can be used when the parameter is random but has uniform prior density? Explain it. [12]

6. a) Determine the Cramer-Rao bound for the variance of any unbiased estimator.

b) Explain Neyman-pearson Criterion for Radar detection of constant amplitude signals. [12]

Contd….2

7. Consider the following message and observation models in which α is an unknown constant parameter.

$$\dot{x}_1(t) = x_2(t)$$
$$\dot{x}_2(t) = -x_1(t) - \alpha x_2(t) + w(t)$$
$$z(t) = x_1(t) + v(t)$$

Where *w(t)* and *v(t)* are zero-mean, white, with unity variance, and uncorrelated with each other. Consider $\alpha(t) = x_3(t)$ as a state and $\dot{x}_3 = 0$. Set up Kalaman filter algorithm for this problem. [12]

8. Write short notes on the following [12]
   (a) Minimum Probability Error Critgerion.
   (b) Kalaman Bucy Filter.

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