APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2016

Electronics and Communication Engineering

(01EC6302 Estimation and Detection Theory)

Max. Marks : 60 Duration: 3 Hours

A

Part A (Any two questions)

1. **Assume that we have three hypotheses**

$$H_0: x[n] = -A + w[n];$$
$$H_1: x[n] = w[n];$$
$$H_2: x[n] = A + w[n];$$

Where A>0 and w[n] is White Gaussian Noise with variance σ^2. If the prior probabilities are equal. Find the probability of error? (9 Marks)

2. **a). For the dc level in White Gaussian Noise problem assume that we wished to have $P_{FA} = 10^{-4}$ and $P_D = 0.99$. If the signal to noise ratio is equal to -30dB. Determine the necessary number of samples? (4 Marks)**

   b). Prove that if the matched filter impulse response is time reversed version of the input signal then it provides maximum signal to noise ratio (5 Marks)

3. **Explain briefly about estimator Correlator (9 Marks)**

Part B (Any two questions)

4. **The data {x[0],x[1].....x[N-1]} are observed where x[n]'s are independently and identically distributed (IID) as $N(0, \sigma^2)$. We wish to estimate the variance**

$$\widehat{\sigma^2} = \frac{1}{N}\sum_{n=0}^{N-1} x^2[n].$$

   Is this an unbiased estimator? Find the the variance of $\widehat{\sigma^2}$ and examine what happens as $N \to \infty$ (9 Marks)

5. **If x[n]=A+Bn+w[n], n=0,1,2,.....N-1. Where w[n] is WGN, determine the CRLB for the slope B and intercept A. Does an efficient estimator exist? And so what is its variance? (9 Marks)**

6. **For the signal model $s[n] = A, 0 \le n \le M-1, s[n] = -A, M \le n \le N-1$. Find the LSE of A and the minimum LS error. Assume that x[n]=s[n]+w[n] for n=0,1,2.....N-1 are observed. If now w[n] is WGN with variance σ^2, find the PDF of LSE. (9 Marks)**

Part C (Any two questions)

7. **Explain properties of kalman filter?** **(12 Marks)**
8. **Explain time varying channel estimation using kalman filter** **(12 Marks)**
9. **Explain application of detection and estimation in the field of communication** **(12Marks)**