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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2017

Electronics and Communication Engineering

01EC6302Estimation and Detection Theory

Max. Marks:60 Duration: 3 Hours

Answer any two questions from each PART

PART A

1. Consider the binary hypothesis problem with received conditional probabilities as shown below. The hypotheses H_0 and H_1 are equally likely. Calculate the minimum probability of error.

$$f(x|H_0)=\frac{1}{2(1-e^{-1})}e^{-|x|} \text{ for } |x|\le 1 \text{ and } f(x|H_1)=\frac{1}{2}\text{rect}\left(\frac{1}{2}\right)$$

(9 Marks)

2. Write a short note on Generalized LikelihoodRatio Test. (9 Marks)

3. a) Derive Bayes risk factor.

   b) Derive Chernoff bound. (9 Marks)

PART B

4. If $x[n]=Ar^n+w[n]$ for n=0,1,...N-1, where A is an unknown parameter, r is a known constant, and w[n] is zero mean white noise with variance σ^2, find the BLUE of A and the minimum variance. Does the minimum variance approach zero as $N \to \infty$?

(9 Marks)

5. Prove that, if Gaussian prior PDF is assumed for an unknown parameter, MMSE and MAP estimator will give same estimate values for that parameter.

(9 Marks)

6. Let x denote the vector composed of three zero mean random variables with a covariance matrix, $C_{xx}=\begin{bmatrix}1 & \rho & \rho^2\\ \rho & 1 & \rho\\ \rho^2 & \rho & 1\end{bmatrix}$. If y = Ax, determine the matrix A, so that the covariance matrix of y is I or equivalently, so that the random variables {yl, y2, y3} are uncorrelated and have unit variance also find the relation between A and C_{xx}.

(9 Marks)

PART C

7. Write a short note on smoothing and filtering operation of Wiener Filter. (12 Marks)
8. Explain scalar Kalman Filter and also derive Minimum prediction MSE. (12 Marks)
9. Explain an application of detection and estimation in pattern recognition. (12 Marks)