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Reg. No. : ....

Name : ....

Second Semester M.Tech. Degree Examination, March 2018
(2013 Scheme)
Branch : Electronics and Communication
Streams : Communication Networks, Signal Processing, Microwave and TV Engineering and Telecommunication
TSC2001 : ESTIMATION AND DETECTION THEORY

Time: 3 Hours Max. Marks : 60

Instructions : *Answer **any two** questions from **each** Module.*
***All** questions carry **equal** marks.*

MODULE – I

1. Consider a random variable $x[0] \sim N(\mu, 1)$. Determine the NP test for distinguishing between the hypotheses $H_0 : \mu=0$ versus $H_1 : \mu = 1$ for this random variable. Find probability of detection (P_D) and probability of false alarm P_{FA}.

2. Design a minimum probability error detector to decide among the hypotheses (H_0, H_1, H_2) whose PDF's are

   $p(x[0]/H_0) = 1/2 \exp(-/x[0] + 1/)$

   $p(x[0]/H_1) = 1/2 \exp(-/x[0]/)$

   $p(x[0]/H_2) = 1/2 \exp(-/x[0]/-1)$

   Assume $P(H_0) = p(H_1) = p(H_2) = 1/3$

   Find minimum probability of error (P_e).

3. Consider the detection of a damped exponential $S[n] = Ar^n$, where A is unknown and r is known ($0 < r < 1$), in presence of AWGN with known variance σ^2. Based on N observations of $x[n] = s[n] + e[n]$ where $e[n]$ is the noise, design Generalised Likelihood Ratio Test (GLRT).

P.T.O.

MODULE – II

4. Consider the detection of a DC level A embedded in white Gaussian noise with variance σ^2 . Find the MMSE estimator for the signal considering the DC level A as random variable with pdf $N(0, \sigma_A^2)$.

5. For the linear system Z(k) = H(k) θ + V[k] where Z[k] is the observation vector, H[k] is deterministic and V[k] is white Gaussian noise with known covariance vector, show that $\underset{MAP}{\hat{\theta}(K)}$ is the most efficient estimator of θ.

6. For the linear system Z(k) = H[k] θ + V[k], where Z[k] is the observation vector, H[k] is random and V[k] is white Gaussian noise, show that the least square estimate of θ, $\underset{WLS}{\hat{\theta}(K)}$ is unbiased if V[K] is zero mean and if V[K] and H[K] are statistically independent.

MODULE – III

7. For a linear system, derive the Kalman filter using the orthogonality principle.

8. Compare Kalman filter and Wiener filter.

9. Define the normal equations associated with the Wiener filtering. Describe the Levinson-Durbin algorithm for solving the normal equations.
