Total No. of Questions : 10] **SEAT No. :**

P3614 **[Total No. of Pages : 3**

[4959]-1100

B.E. (E & TC)

DETECTION AND ESTIMATION THEORY

(2012 Pattern) (Semester - II) (Elective - IV)

Time : 2 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 , Q.7 or Q.8, Q.9 or Q.10.***

2) ***Neat diagrams must be drawn wherever necessary.***

3) ***Figures to the right side indicate full marks.***

4) ***Assume suitable data if necessary.***

Q1) a) Write characteristics of Maximum Likelihood Estimator. **[5]**

b) What is Bayes criteria. Derive the expression for Bayes Dession rule. Under what condition Bayes criteria reduces to LRT and MAP. **[5]**

OR

Q2) a) Explain Recursive Least Square Estimation. **[5]**

b) Explain how decision rule is framed in case of multiple hypothesis tests. **[5]**

Q3) a) Write a short note on Minimum Variance Unbiased Estimator. **[5]**

b) State and explain Cramer - Rao inequality for a Random Parameter. **[5]**

OR

Q4) a) A ternary communication system transmits one of the three amplitude signal $\{1, 2, 3\}$ with equal probabilities. The independent received signal samples under each hypothesis are **[5]**

H1 : YK = 1 + N K = 1,2....K

H2 : Yk = 2 + N K = 1,2.....K

H3 : Yk = 3 + N K = 1, 2, ...K

P.T.O.

The additive noise N is Gaussian with mean zero and variance $\sigma 2$. The costs are Cii = 0 and Cij = 1 for $i \neq j$, Ij, j = 1, 2, 3 determine the decision regions.

b) Explain Bays estimator, least square estimator in detail. **[5]**

Q5) a) Find maximum likelihood estimator of power of WGN with variance $\sigma 2$ unknown with hypothesis H0 and H1 with K no. of samples producing zero and m output respectively. **[8]**

b) Explain Kalmans filter in context of estimation theory. **[8]**

OR

Q6) a) Write a note on Wiener Filter. **[8]**

b) Write a note on Best Linear Unbiased Estimator. **[8]**

Q7) a) Derive the likelihood ratio test (LRT), under the Neyman Pearson (NP) criterion for a binary hypothesis problem. **[8]**

b) In the received signal under hypothesis H_1 and H_0 was **[8]**

$H_1 : Yk = m + N_k, \quad k = 1, 2, ...K$

$H_0 : Y_k = N_k \qquad k = 1, 2, ...K$

i) Assuming the constant m is unknown. Obtain the Maximum Likelihood estimation of the mean.

ii) Suppose now mean 'm' is known but the variance is unknown. Obtain the MLE.

OR

Q8) a) For a binary decision problem the PDF are given as $p(y/H_0) = 1/2e^{-|y|}$ and $p(y/H_1) = e^{-|2y|}$. The costs associated with decission are $C_{00} = C_{11} = 0$ and $C_{01} = 1$, $C_{10} = 2$ and $P(H_1) = 0.75$. Determine the Bayes decision rule. **[8]**

b) Explain best linear unbiased Estimator (BLUE)? **[8]**

Q9) a) Explain the Radar Elementary concepts - Range, Range Resolution, and Unambiguous Range. **[9]**

b) Give a Review of Some CFAR Detectors. **[9]**

OR

Q10) a) What is CFAR Detection and state the Principles of Adaptive CFAR Detection. **[9]**

b) Write short note on Neyman - Pearson detector. **[9]**

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