

Total No. of Questions : 6]

SEAT No. :

P47

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APR. - 17/B.E./Insem. - 54
B.E. (E & TC)
DETECTION AND ESTIMATION THEORY
(2012 Pattern) (Elective - IV) (Semester - II)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *Answer Q. 1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

Q1) a) By considering the radar detection system apply binary hypothesis testing using Bayes' criteria **[6]**

- i) Find probability of correct and wrong decision
- ii) Find average cost
- iii) Find likelihood ratio test

b) Explain the concept of Minimax Criterion in brief. **[4]**

OR

Q2) a) A ternary communication system Transmits one of three amplitude signals {1,2,3} with equal probabilities, **[6]**

The independent received signal samples under each hypothesis are

$$H_1: Y_k = 1 + N \quad k=1,2,\dots,K,$$

$$H_2: Y_k = 2 + N \quad k=1,2,\dots,K,$$

$$H_3: Y_k = 3 + N \quad k=1,2,\dots,K,$$

The additive noise N is Gaussian with zero mean and variance σ^2 , The costs are $C_{ii}=0$, and $C_{ij}=1$, determine the decision regions.

b) Write short note on Composite Hypothesis testing. **[4]**

P.T.O

- Q3)** a) What are the criteria for the good Estimator, calculate the unbiased Estimation of DC level with 'A' as unknown in presence of WGN. [6]
b) Write a note on Generalized Likelihood Ratio Test. [4]

OR

- Q4)** a) Let Y1 and Y2 be two statistically independent Gaussian random variables, such that $E[Y1]=m$, $E[Y2]=3m$, and $\text{var}[Y2]=1$; m is unknown. Obtain the ML estimate of m. [5]
b) Explain Bayes' Estimation in detail. [5]

Q5) In the received signal under hypothesis H_1 and H_0 was [10]

$$H_1: Y_k = m + N_k, \quad k=1, 2, \dots, K$$

$$H_0: Y_k = N_k, \quad k=1, 2, \dots, K$$

- 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

- Q6)** a) What is Cramer Rao Bound inequality and what are its limitations discuss in detail. [5]
b) Write a note on Recursive Least-Square Estimator. [5]

