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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]

