BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.Tech **SEMESTER : II**
BRANCH: ECE **SESSION : SP/19**

SUBJECT: EC563 DETECTION AND ESTIMATION THEORY

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Explain Minimum Variance Unbiased Estimator and discuss Bayes Risk. [5]
Q.1(b) Explain detection theory and discuss least square estimation. [5]

Q.2(a) Derive an expression to evaluate Optimum impulse response of a Matched Filter. Evaluate the maximum signal to noise ratio in the presence of Additive White Gaussian Noise (AWGN). [5]
Q.2(b) Define Ordinary least square Estimator (OLS) and prove that OLS is Best Linear Unbiased Estimator (BLUE). [5]

Q.3(a) Discuss Receiver Operating Characteristics. Obtain Diagonalization matrix for [5]

$$\begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & -3 \\ -3 & 1 & 9 \end{pmatrix}$$

Q.3(b) Derive expression for Moment Generating Function and establish Chernoff bound. [5]

Q.4(a) Explain the working of Kalman Filter with the help of suitable flow chart. Calculate kalman gain, current estimate and Estimation error for true temperature 72, Error in estimate 2, Previous estimate 68, measurement 75, Error in measurement 4 and initial estimate 68. [5]
Q.4(b) Derive expression for Cramer Rao lower bound. Discuss Matched Filter and its linear model. [5]

Q.5(a) Discuss Maximum Liklihood estimator. [5]
Q.5(b) A coin is tossed. If coin shows head toss it again but if it shows tail than throw a dice. Find the probability that the die shows a number grater than 3. Given that there is at least a tail. [5]

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