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

CLASS: MTECH **SEMESTER : II**
BRANCH: ECE **SESSION : SP/2024**

SUBJECT: EC523 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.

			CO	BL
Q.1(a)	Verify if the matrix p is orthogonal and hence find its inverse $P=\frac{1}{3}\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -2\\ -2 & 2 & -1\end{bmatrix}$	[5]	1	3
Q.1(b)	Diagonalize matrix A, and justify your answer $A=\begin{bmatrix}2 & 0 & 0\\ 1 & 2 & 1\\ -1 & 0 & 1\end{bmatrix}$	[5]	1	3
Q.2(a)	Mention Neyman-Pearson lemma (all the three) and derive the condition to determine best of size for the test.	[5]	2	2,3
Q.2(b)	Derive an expression to present probability of false alarm in terms of density of random variable	[5]	2	3
Q.3(a)	Using Neyman-Pearson approach design a matched filter for detecting a known deterministic signal in white gaussian noise	[5]	3	4
Q.3(b)	Derive an expression for Minimum Bayes Risk Detector-Binary Hypothesis	[5]	3	3
Q.4(a)	For Wireless Sensor Network environment determine minimum number of sensors (N) required so that the probability that the estimate H lies within (ϕ/2) of the true parameter h is greater than 0.9999 or 99.99% reliability. Use Maximum Likelihood Estimate approach	[5]	4	4
Q.4(b)	Derive an expression to evaluate Cramer Rao lower bound for any unbiased estimator	[5]	4	3
Q.5(a)	With the help of suitable block diagram explain Multi-dimensional Kalman filter-Model 1.	[5]	5	3
Q.5(b)	For Kalman filter design, determine the Kalman Gain and current estimate, If the true temperature is 72, Error in estimate is 2, previous estimate is 68, Measurement is 75 and error in measurement is 4. Show calculation for at-least four stages.	[5]	5	4

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