PAPER ID-411574

Roll No: | | | | | | | | | | | | | |

MTECH
(SEM II) THEORY EXAMINATION 2023-24
DETECTION AND ESTIMATIONTHEORY

TIME: 3 HRS **M.MARKS: 70**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a.	What is binary hypothesis testing?
b.	What is the minimax criterion?
c.	What is signal detection in discrete time?
d.	What is the probability of detection?
e.	Define the MMSE estimate.
f.	Define linear estimation.
g.	Define Gaussian noise.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a.	Explain the differences between Type I and Type II errors, and their significance in hypothesis testing
b.	Explain the methods used for the detection of stochastic signals.
c.	Discuss the fundamental principles of Bayesian parameter estimation and its advantages over classical methods.
d.	What is the discrete-time Kalman-Bucy filter?
e.	Explain the derivation and application of the matched filter in signal detection

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

a.	Explain how the power of a test is calculated and its importance in hypothesis testing.
b.	Discuss the importance of selecting appropriate priors in Bayesian hypothesis testing.

4. Attempt any *one* part of the following: 7 x 1 = 7

a.	Describe the likelihood ratio test and its application in signal detection.
b.	Explain the concept of signal-to-noise ratio (SNR) and its importance in signal detection.

5. Attempt any *one* part of the following: 7 x 1 = 7

a.	Discuss the principles and steps involved in Maximum Likelihood (ML) estimation. You observe a sample x= [1,2,3,4,5], from a normal distribution N (μ, σ^2), with σ^2=1. Calculate the MLE for μ.
b.	Explain the concept of consistency for MLEs and how it is demonstrated in large samples.

6. Attempt any *one* part of the following: 7 x 1 = 7

a.	Describe the linear estimation process and its applications in signal processing.
b.	Describe the process of designing a Wiener filter for a given signal estimation problem.

7. Attempt any *one* part of the following: 7 x 1 = 7

a.	Discuss the importance of SNR in evaluating the performance of detection systems.
b.	Explain the Neyman-Pearson criterion and its application in hypothesis testing.