Detection and Estimation Theory(404184)

Teaching Scheme:
Lectures:4 Hrs/ Week

Examination Scheme:
In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase III: 70

Course Objectives:

- To understand concepts of statistical decision theory and parameter estimation.
- To study application of detection and estimation theory in filtering, communication and radar.

Course Outcomes:

After successfully completing the course students will be able to

- Apply suitable hypothesis testing criteria for signal detection problems.
- Use parameter estimation in signal processing and communication problems.
- Design a estimator and detector.

Unit I : Statistical Decision Theory 7L

Introduction, Bayes' Criterion-Binary Hypothesis Testing, *M*-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing, Sequential Detection.

Unit II : Parameter Estimation-I 7L

Introduction, Some Criteria for Good Estimators, Maximum Likelihood Estimation, Generalized Likelihood Ratio Test, Bayes' Estimation

Unit III : Parameter Estimation-II 7L

Cramer-Rao Inequality, Multiple Parameter Estimation, Best Linear Unbiased Estimator, Least-Square Estimation, Recursive Least-Square Estimator.

Unit IV : Filtering 7L

Introduction, Linear Transformation and Orthogonality Principle, Wiener Filters, Discrete Wiener Filters, Kalman Filter.

Unit V : Detection and Parameter Estimation 7L

Introduction, Signal Representation, Binary Detection, M-ary Detection, Linear Estimation.

Unit VI : Detection Theory in Radar 7L

Introduction, Radar Elementary concepts- Range, Range Resolution, and Unambiguous Range, Doppler Shift, Principles of Adaptive CFAR Detection- Target Models, Review of Some CFAR Detectors.

Text Books

4. Mourad Barkat, "Signal detection and Esimation", Artec House, second edition
5. S M Kay, "Fundamentals of ststistical Signal Processing, Estimation Theory" PHI Signal Processing Series.
6. S M Kay, "Fundamentals of ststistical Signal Processing, Detection Theory" PHI Signal Processing Series.

Reference Books

9. H.Vincent Poor, "An Introduction to Signal Detection and Estimation", Springer, Second Edition.
10. Harry L.,Van Trees, "Detection, Estimation and Modulation Theory", John Wiley & Sons.