Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NECC533	Estimation and Detection Theory	3	1	0	4

Course Objective
This course deals with the various estimation and detection techniques that are used in signal processing.
Learning Outcomes
At the end of the course, the student must be able to do research in the designing of estimation framework for the various signal processing applications.

Module No.	Topics to be Covered	Lecture +Tutorial Hours	Learning Outcome
1	Gaussian variables and processes, Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound sufficient statistics, minimum statistics, complete statistics.	10+4T	Acquire an understanding of the basic probability theory and unbiased estimator
2	linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency. Bayesian estimation, risk functions, minimum mean square error estimation, maximum a posteriori estimation; Discrete-Time Linear Bayesian estimation, stochastic approximation.	11L+4T	Develop an understanding about the concept of classical estimator and Bayesian Estimator.
3	signal detection and signal parameter estimation in discrete-time domain. Bayesian, minimax, and Neyman-Pearson detection; likelihood ratio, receiver operating characteristics, composite hypothesis testing. Locally optimum tests, detector comparison techniques, asymptotic relative efficiency.	10L+4T	Understand the concept of detection theory with hypothesis testing.
4	Matched filter detector and its performance; detection under colored noise, detection under Non-Gaussian Noise, generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time	11L+2T	Understand the concept of detection theory for non-Gaussian noise scenario.
	Total	**42L+14T**	

Textbook:

1. Kay, Steven M. "Fundamentals of statistical signal processing, volume i: Estimation theory PTR Prentice-Hall, Englewood Cliffs, 201
2. Kay, Steven M. "Fundamentals of statistical signal processing, Vol. II: Detection Theory." Signal Processing. Upper Saddle River, NJ: Prentice Hall, 2010.

Reference Books:

1. Levy, Bernard C. Principles of signal detection and parameter estimation. Springer Science & Business Media, 2008.