ECMC2T5C: Radar Signal Processing

Unit-I: Introduction to Radar Systems
History and applications of radar, basic radar functions, elements of pulsed radar, review of selected signal processing concepts and operations. A preview of basic radar signal processing.

Unit-II: Signal Models
Components of a radar signal, amplitude models, clutter, noise model and signal to noise ratio, jamming, frequency models, spatial models, spectral model.

Unit-III: **Sampling and Quantization of Pulsed Radar Signals**
Domains and criteria for sampling radar signals. Sampling in the fast time domain, sampling in slow time domain, sampling the Doppler spectrum. Sampling in the spatial and angle dimensions, quantization.

Unit-IV : **Radar Wave Forms**-I
Introduction, the wave form matched filter, matched filtering of moving targets, the ambiguity function.

Unit-V: **Radar Wave Forms**-II
The pulse burst wave form, frequency modulated pulse compression wave forms. Range side lobe control for FM waveforms, the stepped frequency wave form, pulse modulated pulse compression waveforms. Costas frequency codes.

Unit-VI : **Doppler Processing**
Alternate forms of Doppler spectrum, Moving Target Indication (MIT), pulse Doppler processing, pulse pair processing, clutter mapping and the moving target detector.

Unit-VII : **Detection Fundamentals**
Radar detection as hypothesis testing, Threshold detection in coherent systems, Threshold detection of radar signals, binary integration.

Unit-VIII : **Constant False Alarm Rate (CFAR) Detection**
The effect of unknown interference power on false alarm probability. Cell-Averaging CFAR, analysis of Cell-Averaging CFAR, limitations of Cell-Averaging CFAR, order statistic CFAR. Spatial filtering, SAR fundamentals.

Text Books

1. Fundamentals of Radar Signal Processing,-Mark A.Richards.,Tata McGraw-Hill,Ed-2005.
2. Radar Design Principles,- Fred E.Nathanson, 2nd Edition, Prentice-Hall of India, New Delhi,2004.

Reference Books

1. Radar Principles, Technology, Applications,- Byron Edde, Prentice-Hall of India
2. Radar Principles. Peyton Z.Peebles Jr. John-Wiley & Sons Inc., 2004.
3. Radar Foundations for Imaging and Advanced Concepts,- Roger J.Sullivan, Prentice-Hall of India, New Delhi-2004.