

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Semester: III

Signal Processing & VLSI Technology (EC)

Subject Name: **Radar Signal Processing (Major Elective - IV)**

Subject Code: **732602**

Sr No.	Course Content
1	INTRODUCTION TO RADAR SYSTEMS : History and application of radar, basic radar function, elements of a pulsed radar, review of signal processing concepts and operations, A preview of basic radar signal processing, radar system components, advanced radar signal processing
2	SIGNAL MODELS: Components of a radar signal, amplitude models, types of clutters, noise model and signal-to-noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model
3	SAMPLING AND QUANTIZATION OF PULSED RADAR SIGNALS: Domains and criteria for sampling radar signals, Sampling in the fast time dimension, Sampling in slow time: selecting the pulse repetition interval, sampling the doppler spectrum, Sampling in the spatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q
4	RADAR WAVEFORMS: Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range sidelobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency Codes.
5	DOPPLER PROCESSING: Alternate forms of the doppler spectrum, Moving target indication (MTI), Pulse doppler processing, dwell-to-dwell stagger, Pulse pair processing, additional doppler processing issues, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phase center antenna processing
6	DETECTION FUNDAMENTALS: Radar detection as hypothesis testing, threshold detection in coherent systems, threshold detection of radar signals
7	CONSTANT FALSE ALARM RATE (CFAR) DETECTION: The effect of unknown interference power on false alarm probability, cell averaging CFAR, analysis of cell-averaging CFAR, CA- CFAR limitations, extensions to cell-averaging CFAR, order statistic CFAR, additional CFAR topics

8	<p>INTRODUCTION TO SYNTHETIC APERTURE IMAGING:</p> <p>Introduction to SAR fundamentals, Stripmap SAR data characteristics, stripmap SAR image formation algorithms, Spotlight sar data characteristics, the polar format image formation algorithm for spotlight SAR, Interferometric SAR.</p>
9	<p>INTRODUCTION TO BEAMFORMING AND SPACE-TIME ADAPTIVE PROCESSING:</p> <p>Spatial filtering, space-time signal environment, space-time signal modeling, processing the space-time signal, computational issues in STAP, reduced-dimension STAP, advanced STAP algorithms and analysis, limitations to STAP</p>

Reference Books:

1. Fundamentals of Radar Signal Processing, Mark A. Richards McGraw-Hill, New York, 2005
2. Principles of Radar and Sonar Signal Processing, Francois Le Chevalier, Artech House
3. Radar systems, Peak Detection and Tracking, Michael O Kolawole, 2010, Elsevier
4. Introduction To Radar Systems 3/E, Skolnik, McGraw Hill.
5. Radar Principles, Peyton Z. Peebles, 2009 Wiley India
6. Radar Design Principles-Signal Processing and the environment, Fred E. Nathanson, PHI