

EC731PE: RADAR SYSTEMS (PE – III)**B.Tech. IV Year I Semester**

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Prerequisite: Analog and Digital Communications**Course Objectives:**

1. To explore the concepts of radar and its frequency bands.
2. To understand Doppler effect and get acquainted with the working principles of CW radar, FM-CW radar.
3. To impart the knowledge of functioning of MTI and Tracking Radars.
4. To explain the designing of a Matched Filter in radar receivers.

Course Outcomes: Upon completing this course, the student will be able to

1. Derive the complete radar range equation.
2. Familiarize the functioning of CW, FM-CW and MTI radars
3. Known various Tracking methods.
4. Derive the matched filter response characteristics for radar receivers.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	1	1	-	-	-	-	1
CO2	3	1	2	2	-	1	1	-	-	-	-	1
CO3	3	1	2	2	-	1	1	-	-	-	-	1
CO4	3	1	2	2	-	1	1	-	-	-	-	1

UNIT - I

Basics of Radar: Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation.

Radar Equation: SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment).

UNIT - II

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar.

FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter.

UNIT - III

MTI and Pulse Doppler Radar: Principle, MTI Radar – Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

UNIT - IV

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT - V

Detection of Radar Signals in Noise Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

Radar Receivers – Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

TEXT BOOKS:

1. Merrill I. Skolnik- Introduction to Radar Systems, 2nd Edition, TMH Special Indian Edition, 2007.

REFERENCE BOOKS:

1. Byron Edde - Radar: Principles, Technology, Applications, Pearson Education, 2004.
2. Peebles, Jr., P.Z., Wiley - Radar Principles, New York, 1998.
3. Mark A. Richards, James A. Scheer, William A. Holm, Yesdee - Principles of Modern Radar: Basic Principles, 2013
4. Merrill I. Skolnik -Radar Handbook, 3rd Edition., McGraw-Hill Education, 2008.