

IV B.Tech II Semester

15AEC82 - RADAR AND NAVIGATIONAL AIDS

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Course Objectives:

1. The students to be able to understand, analyze, and design fundamental Basic radar systems.
2. To know various Radar systems such as pulse radar, CW radar etc.
3. To understand various Radar systems techniques and their applications.
4. Understanding of Radar systems by using a series of specific examples and problems

UNIT I

BASICS OF RADAR: Introduction, 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, Illustrative Problems. Radar Equation: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

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, Illustrative Problems. FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT III

MTI AND PULSE DOPPLER RADAR: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

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

UNIT IV

DETECTION OF RADAR SIGNALS IN NOISE: Introduction, 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, Series versus Parallel Feeds, Applications, Advantages and Limitations.

UNIT V

NAVIGATIONAL AIDS: Introduction, Four Methods of Navigation, Radio Direction Findings, Radio Ranges, Hyperbolic Systems of Navigation, Aids to approach and Landing

MODERN NAVIGATION: Doppler navigation-Doppler Effect, New configuration, Doppler frequency equations, Track stabilization, Doppler navigation system, GPS principle of operation, Position location determination, principle of GPS receiver

Course Outcomes: At the end of the course, the students should be able to:

- a. Able to understand The Radar Operation and targets of the system
- b. Know the difference between MTI radar, monopulse radar, and apply their concepts in the analysis and design of Tracking systems.
- c. Understand the basic principles of Radar receiver and their schemes.
- d. Analyze noise in the case of detection of Radar receiver in radar systems.
- e. Able to know the methods of navigation, approaches and landing.
- f. Able to understand the Modern navigational approaches.

TEXT BOOKS:

1. Merrill I. Skolnik, "Introduction to Radar Systems," 2nd Edition, TMH Special Indian Edition, 2007.
2. Byron Edde, "Radar Principles, Technology, Applications," Pearson Education, 1992.

REFERENCES:

1. Introduction to Radar Systems – Merrill I. Skolnik, 3rd Edition, Tata McGraw-Hill, 2001.
2. Peebles, "Radar Principles," Wiley, New York, 1998.



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