V Year B.Tech. ECE II - Semester

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EC420 RADAR SYSTEMS
(Dept. Elective - VI)

Course Description & Objectives:

To introduce the components of a radar system and their relationship to overall system performance, the radar operating environment and techniques used to confront it, and top level measures of performance.

Course Outcomes:

Upon successful completion of this course, students should be able to:

a. *Understand the essential principles of operation of radar systems.*

b. *Apply appropriate mathematical and computer models relevant to radar systems to calculate system.*

c. *Understand the design of radar signals, and FM radar.*

d. *Design simple radar systems and the associated signal processing, at block diagram level.*

e. *Understand the principles of Electronic Warfare, stealth and counterstealth, and bistatic radar, and apply the appropriate design equations to calculate performance.*

f. *Analyze the performance of simple tracking radar systems.*

g. *Apply the relevant design equations to phased array antennas, and understand the advantages.*

UNIT I - Introduction & Radar Range :

Introduction, Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Radar Equation: Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR,Integration of Radar Pulses, Radar Cross Section of Targets.

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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 (Approaching/ Receding Targets), FM-CW altimeter, Measurement Errors, 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, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler radar.

UNIT IV -Tracking Radar& Radar Antennas :

Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar Antenna Parameters, Reflector Antennas, Lens Antennas, Cosecant Squared Antenna Patterns, Radomes, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency Scan Arrays, Radiators for Phased Arrays.

UNIT V - Detection of Radar Signals in Noise & Radar Receivers :

Introduction, Matched Filter Receiver Response Characteristics and Derivation, Correlation detection, Detection criteria. Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver.

Radar Receivers:Noise Figure and Noise Temperature. Display 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.

TEXT BOOKS :

1. Introduction to Radar Systems Merrill I. Skolnik, SECOND EDITION, McGraw-Hill, 1981.

REFERENCE BOOKS :

1. Introduction to Radar Systems Merrill I. Skolnik, THIRD EDITION, Tata McGraw-Hill, 2001.2.
2. Radar: Principles, Technologies, ApplicationsByron Edde, Pearson Education.

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