IVB.Tech I Semester (E.C.E)

23A04702a	**RADAR ENGINEERING**	**L**	**T**	**P**	**C**
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Course Objectives:

1. To understand the basic working principle of Radar and target detection procedure.
2. To learn about the working and applications of CW and Frequency modulated Radar.
3. To comprehend the working and applications of MTI and Pulse Doppler Radar
4. To understand different methods of tracking a target and their limitations.
5. To analyze the effect of noise at the receiver and uses of phased array antennas and navigational aids.

Course Outcomes:

At the end of this course, the students will be able to

1. Learn the basic working principle of Radar and target detection procedure.
2. Know the working and applications of CW and Frequency modulated Radar.
3. Gain the knowledge of about MTI and Pulse Doppler Radar.
4. Understand different methods of tracking a target and their limitations.
5. Analyze the effect of noise at the receiver and uses of phased array antennas and navigational aids.

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), Display types, 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.

UNIT IV

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 V

Detection of Radar Signals in Noise: Introduction, Noise Figure and Noise Temperature, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver. Introduction to Software Defined Radio,Introduction to Stealth technology.

Radar Receivers: Introduction to Phased Array Antennas- Basic Concepts, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency – scan Arrays, Radiation for Phased Array, Architecture for Phased Arrays. Radiation Pattern. Beam Steering and Beam Width changes. Navigational Aids : Direction Finder, VOR,ILS and Loran.

TEXT BOOKS:

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

REFERENCES:

1. Peebles, “Radar Principles”, Wiley, New York, 1998.
2. G.S.N.Raju, “Radar Engineering and Fundamentals of Navigational Aids”, I. K. International Pvt. Ltd.
3. G. SasiBhushan Rao, “ Microwave and Radar Engineering”, Pearson Education, 2014