

Radar Engineering

CourseCode	23EC4702B	Year	IV	Semester	I
Course Category	PE-V	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Communications, Antennas and wave propagation
ContinuousInternal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes		
	Upon successful completion of the course, the student will be able to	BL
CO1	Interpret the complete radar range equation and statistical parameters of Noise	L3
CO2	Analyze fixed and moving targets using different types of radar systems	L4
CO3	Apply the concepts of tracking and different tracking techniques.	L3
CO4	Identify various components in radar receivers for detection of signals in noise, different types of displays and duplexers.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3											1	2
CO2	3	2										1	2
CO3	3											1	2
CO4	3											1	2
Avg.	3	2										1	2

Syllabus		
UnitNo.	Contents	Mapped CO
1	Basics of Radar: Introduction, Maximum Unambiguous Range, simple Radar Range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Illustrative Problems Radar Equation : Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.	CO1
2	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, FM-CW altimeter, Multiple Frequency CW Radar.	CO2
3	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 versus Pulse Doppler Radar.	CO2
4	Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse, Phase Comparison Mono pulse, Comparison of Trackers.	CO3

5	Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise, Noise Figure and Noise Temperature. Displays – types. Duplexers – Branch type and Balanced type.	CO4
---	---	-----

Learning Resources	
Text Books	
1	Merrill I. Skolnik, Introduction to Radar Systems , 2 nd Ed., TMH Special Indian Edition, 2007.
Reference Books	
1	Byron Edde, Radar: Principles, Technology, Applications –Pearson Education, 2004
2	Peebles, Jr., P.Z., Radar Principles –Wiley, New York, 1998.
3	Mark A. Richards, James A. Scheer, William A. Holm, Yesdee, Principles of Modern Radar: Basic Principles –2013
4	GSN Raju, Radar Engineering –IK International, 2020
e- Resources & other digital material	
1.	https://deebak.wordpress.com/wp-content/uploads/2009/05/skolnik.pdf