

## RADAR SYSTEMS

<b>Course Code</b>	19EC4702D	<b>Year</b>	IV	<b>Semester</b>	I
<b>Course Category</b>	Program Elective - V	<b>Branch</b>	ECE	<b>Course Type</b>	Theory
<b>Credits</b>	3	<b>L-T-P</b>	3-0-0	<b>Prerequisites</b>	AC, AAS
<b>Continuous Internal Evaluation:</b>	30	<b>Semester End Evaluation:</b>	70	<b>Total Marks:</b>	100

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### Course Outcomes

Upon successful completion of the course, the student will be able to	
<b>CO1</b>	Interpret the complete radar range equation and statistical parameters of Noise L2
<b>CO2</b>	Analyse the fixed and moving targets using different types of radar systems. L4
<b>CO3</b>	Identify various tracking methods, different types of display devices & duplexers. L3
<b>CO4</b>	Apply the various techniques in radar receivers for detection of signals in noise. L3

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COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO11	PO12	PSO1	PSO2
CO1	3	3	1							1	2
CO2	3	1	2							1	2
CO3	3	3	2							1	2
CO4	3	3	2							1	2
<b>Average* (Rounded to nearest integer)</b>	3	3	2							1	2

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### Syllabus

Unit No.	Contents	Mapped CO
I	<b>Nature of Radar:</b> Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses	CO1
II	<b>CW and Frequency Modulated Radar :</b> 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, Multiple Frequency CW Radar.	CO2
III	<b>MTI and Pulse Doppler Radar:</b> 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, Non-coherent MTI, MTI versus Pulse Doppler Radar.	CO2

IV	<b>Tracking Radar:</b> Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one and two coordinates), Phase Comparison Monopulse. Comparison of Trackers.	<b>CO3</b>
V	<b>Detection of Radar Signals in Noise :</b> 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.	<b>CO4 &amp; CO5</b>

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### Learning Resources

#### Text Books

1. Introduction to Radar Systems – Merrill I. Skolnik, 2<sup>nd</sup> Edition, McGraw-Hill.
2. Microwave and Radar Engineering – Gottapu Sasi Bhushana Rao

#### Reference Books

1. Introduction to Radar Systems – Merrill I. Skolnik, 3<sup>rd</sup> Edition, Tata McGraw- Hill,
2. Understanding Radar Systems – Simon kingsley, McGraw-Hill, 1st edition., 1992
3. Radar Principles- Peyton Z. Peebles, Jr., Wiley India Pvt. Ltd., 2009

#### e- Resources & other digital material

1. <https://deebak.files.wordpress.com/2009/05/skolnik.pdf>