

Radar Engineering B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15EC833	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to: <ul style="list-style-type: none"> • Understand the Radar fundamentals and analyze the radar signals. • Understand various technologies involved in the design of radar transmitters and receivers. • Learn various radars like MTI, Doppler and tracking radars and their comparison 			
Modules			RBT Level
Module-1			
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation , Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. (Chapter 1 of Text)			L1, L2, L3
Module-2			
The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Probability of Detection, Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. (Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11)			L1, L2, L3
Module-3			
MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler, Digital MTI Processing – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. (Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text)			L1, L2, L3
Module-4			
Tracking Radar: Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse. Sequential Lobing , Conical Scan Tracking, Block Diagram of Conical Scan			L1, L2, L3

Tracking Radar, Tracking in Range, Comparison of Trackers. (Chapter 4: 4.1, 4.2, 4.3 of Text)	
Module-5	
The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. (Chapter 9: 9.1, 9.2 9.4, 9.5 of Text) Radar Receiver: The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. (Chapter 11 of Text)	L1, L2, L3
Course outcomes: At the end of the course, students will be able to: <ul style="list-style-type: none"> • Understand the radar fundamentals and radar signals. • Explain the working principle of pulse Doppler radars, their applications and limitations • Describe the working of various radar transmitters and receivers. • Analyze the range parameters of pulse radar system which affect the system performance 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book: Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.	
Reference Books: <ol style="list-style-type: none"> 1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004. 2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998. 3. Principles of Modern Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. Holm. Yesdee, 2013 	



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