Semester:7th	Department of Electronics and communication Engineering	AY: 2026-27
Course Code: BEC714D	Course Name: Radar Communicatrion	

Question Bank

Q.	Module-01	M	L	C
1.	Explain the basic block diagram of a conventional pulse radar system with a superheterodyne receiver, detailing the exact function of each block.	8	L2	CO1
2.	Derive the simple form of the Radar Range Equation from fundamental principles.	8	L2	CO1
3.	Discuss the impact of each parameter inside the modified Radar Range Equation on the maximum detection range (\(R_{max}\)).	8	L2	CO1
4.	Explain the terms minimum detectable signal (\(S_{min}\)) and receiver noise floor, and show how they limit radar sensitivity.	7	L2	CO1
5.	Derive the relationship between the probability of detection, the probability of false alarm, and the integration of radar pulses.	8	L3	CO1
6.	Define Radar Cross Section (RCS) of a target. Explain how the RCS fluctuates and describe the RCS behaviors of a simple sphere vs. a cone-sphere target.	8	L2	CO1
7.	Explain the parameters Peak Power, Average Power, and Duty Cycle, providing the formulas that relate them to pulse width and Pulse Repetition Frequency (PRF).	6	L2	CO1
8.	Analyze the problem of Range Ambiguity and calculate the maximum unambiguous range (\(R_{un}\)) for a given PRF.	8	L4	CO1
9.	List and explain the different types of system losses that degrade performance, including microwave plumbing losses, antenna losses, and operator losses.	7	L2	CO1
10.	Solve the following problem: A 10 GHz radar operates with a peak pulse power of 250 kW. If the antenna gain is 40 dB and the minimum detectable signal is 10^{-11} W, find the maximum detection range for a target with an RCS of 2 m^2.	5	L3	CO1
	Module-02			
11.	Explain the basic principle of a CW Doppler radar with a neat block diagram, noting its primary applications and limitations.	9	L2	CO2
12.	Describe the operating principle of a Moving Target Indicator (MTI) radar using a power amplifier transmitter setup.	8	L2	CO2
13.	What are "Blind Speeds" in MTI radars? Derive the mathematical expression for blind speeds and list methods to mitigate them.	9	L3	CO2

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14.	Explain the functional working of a single delay-line canceller and derive its complete frequency response profile.	10	L3	CO2
15.	Differentiate clearly between an MTI radar and a Pulse Doppler radar, highlighting differences in PRF choices and duty cycles.	8	L4	CO2
16.	Describe the block diagram and operation of a Moving Target Detector (MTD) system.	8	L2	CO2
17.	Explain the technique of Amplitude Comparison Monopulse tracking radar with the help of a clean schematic layout.	8	L2	CO2
18.	Discuss Phase Comparison Monopulse tracking radar and explain how it determines angular error signals.	8	L2	CO2
19.	Explain the working principle of Conical Scanning and Sequential Lobing tracking methods, noting how they vary from monopulse systems.	8	L2	CO2
20.	Write short notes on: (a) Range tracking circuits, and (b) The limitations of tracking accuracy due to target glint.	6	L2	CO2
	Module-03			
21.	Discuss the methods used for fundamental radar measurements: Range, Angle, Radial Velocity, and Tangential Velocity.	8	L2	CO3
22.	Derive the surface clutter radar equation and define the scattering coefficient σ^0.	9	L3	CO3
23.	Explain land clutter characteristics at low grazing angles versus medium grazing angles.	7	L2	CO3
24.	Describe the statistical behavior and characteristics of high-resolution sea clutter.	7	L2	CO3
25.	Analyze forward scattering from a flat earth using vector and mathematical derivations.	9	L4	CO3
26.	Explain the rough surface reflection coefficient and clarify its variations using visual graphic trends.	7	L2	CO3
27.	Discuss the phenomenon of anomalous propagation (ducting) and how it affects the operational range of a radar.	8	L2	CO3
28.	Explain the structural properties of atmospheric refraction and define the standard "4/3 earth radius" model.	6	L2	CO3
29.	Explain the exponential model of refractivity used to correct propagation models.	6	L2	CO3
30.	List and explain the key methods applied to practically measure and determine atmospheric refractivity.	7	L2	CO3
	Module-04			
31.	Draw and explain the operation of a Linear Beam Power Tube Klystron amplifier used in high-power radar transmitters.	9	L2	CO4
32.	Describe the operating mechanism of a Traveling Wave Tube (TWT) and state its advantages over a standard Klystron.	8	L2	CO4

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33.	List and compare the different types of modern solid-state RF power sources used in compact radar systems.	7	L4	CO4
34.	Explain active aperture, electronically steered phased arrays and discuss their structural benefits in modern deployment.	8	L2	CO4
35.	Define Receiver Noise Figure (F) and derive the cascading equation (Friis formula) for the total noise figure of networks connected in series.	9	L3	CO4
36.	Explain the working architecture of a modern radar superheterodyne receiver using a comprehensive block diagram.	8	L2	CO4
37.	Define and explain the significance of the following receiver parameters: (a) Dynamic Range, (b) Flicker Noise, (c) Oscillator Stability, and (d) Phase Noise.	8	L2	CO4
38.	What is a Duplexer? With the aid of diagrams, explain the operation of a Branch-type duplexer during both transmit and receive cycles.	9	L2	CO4
39.	Explain the operation of a Balanced Duplexer using a neat diagram, noting its performance metrics over branch-type designs.	8	L2	CO4
40.	List and clarify the operation of different Solid-State receiver protectors and diode limiters used to shield sensitive low-noise amplifiers.	6	L2	CO4
	Module-05			
41.	Explain the basic concept of Synthetic Aperture Radar (SAR) and how it achieves exceptionally high cross-range (azimuth) resolution.	8	L2	CO5
42.	Derive the expression for cross-range resolution of a SAR system along its Line-of-Sight (LOS) axis.	9	L3	CO5
43.	Derive the specialized Radar Range Equation tailored specifically for Synthetic Aperture Radar (SAR) systems.	10	L3	CO5
44.	Discuss the primary signal processing workflows utilized to reconstruct images from raw SAR data echoes.	8	L2	CO5
45.	Outline the essential system design considerations when engineering a spaceborne or airborne SAR platform.	7	L2	CO5
46.	Introduce Over-the-Horizon Radar (OTHR), detailing its core classifications (Sky-wave vs. Ground-wave).	6	L2	CO5
47.	Explain the ray path trajectories and the role of ionospheric refraction layers in enabling OTHR systems to see past the horizon curvature.	8	L2	CO5
48.	Explain the fundamental principles of Secondary Surveillance Radar (SSR) and how it differs from primary cooperative radars.	8	L2	CO5
49.	Identify the major operational deficiencies found in traditional	6	L1	CO5

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	SSR systems (such as fruit, garbling, and antenna shielding).			
50.	Explain the technological solutions developed to overcome classic SSR problems, highlighting the structural design of Mode S tracking systems.	8	L2	CO5

***Note:**

1. All modules should contain a minimum of **10** questions each and the total number of questions must be **50**.
2. Questions can carry marks of 06, 07, 08, 09, 10 and for problems: 04 or 05.
3. Follow the RBTL as per the keywords used to frame the questions.
4. Maintain the Course Outcomes (COs) as per the syllabus.
5. M: Marks, L: RBTL, C:COs.

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