JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

B.Tech-VIII Semester (ECE)

COURSE CODE(CREDITS): 18B1WEC839 (3) MAX. MARKS: 25

COURSE NAME: Radar Principles and Applications

COURSE INSTRUCTORS: Dr. Vikas Baghel MAX. TIME: 1 Hour 30 Minutes

Note: *(a)All questions are compulsory.*

(b)Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

Q1.	**a)**	Consider a radar system operating at a frequency of 10 GHz with a transmitted power of 1000 W. A target with an area of 5 square meters is illuminated by the radar beam. Assuming ideal conditions and neglecting all losses, calculate the radar cross-section (RCS) of the target.	[2]	[CO1]
	b)	Describe the working principle of a PPI display in radar systems.	[2]	
	c)	What type of radar is commonly used for air traffic control? Explain.	[1]	
Q2.	**a)**	Describe the components and working principle of a CW radar system using a block diagram, highlighting how continuous wave transmission and reception are utilized for target detection and ranging.	[3]	[CO2]
	b)	How does FMCW radar differ from traditional pulse radar? What is the advantage of FMCW radar in terms of range resolution?	[2]	
	c)	A weather radar system emits a signal with a frequency of 5 GHz. If the radar detects rainfall droplets moving towards it at a speed of 10 m/s, what is the observed frequency shift (Doppler shift) experienced by the radar system?	[2]	
Q3.	**a)**	Discuss the significance of Doppler filtering in MTI radar systems. How does Doppler filtering help in isolating moving targets from clutter?	[2]	[CO2]
	b)	Explain the principle of operation behind a delay line canceller in radar systems. How does it mitigate unwanted signals?	[2]	
	c)	A radar system with an MTI capability has a pulse repetition frequency (PRF) of 10 kHz. If the maximum unambiguous range of the radar is 100 km, calculate the maximum detectable velocity of a target without encountering range ambiguity.	[1]	
	d)	An MTI radar system operates with a radar frequency of 5 GHz and uses a pulse width of 1 μs. Calculate the maximum unambiguous range of the radar system if it has a PRF of 5 kHz.	[1]	
Q4.	**a)**	What is pulse compression in radar systems? How does pulse compression improve the range resolution of a radar system?	[2]	[CO3]
	b)	Explain the difference between linear frequency modulation (LFM) and nonlinear frequency modulation (NLFM) in pulse compression techniques.	[2]	
	c)	A radar system uses a pulse compression technique with a pulse width of 10 μs and a compression ratio of 100. Calculate the compressed pulse width.	[1]	
	d)	Find the matched filter output of Barker code of length 5.	[2]	