Reg. No. : | | | | | | | | | | | | |

Question Paper Code:U2903

Ph.D. COURSE WORK EXAMINATION, MAY 2024

Electives

Communication Systems

21PCM503- RADAR SIGNAL PROCESSING

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1.	(a)	A radar sends a short pulse of microwave electromagnetic energy directed towards the moon. Some of the energy scatters off of the moon's surface and returns to the radar. What is the round trip time? If the target was an aircraft 150 nmi distant, what is the round trip time?	CO4- App	(20)
		Or		
	(b)	A radar generates 200 kW of peak power at the power tube and has 2 dB of loss between the power tube and the antenna. The radar is monostatic with a single antenna that has a directivity of 36 dB and a loss of 1 dB. The radar operates at a frequency of 5 GHz. (i)Determine the ERP, in dBW, for the radar. (ii)Determine the ERP in watts. (iii)Determine the power at the receive antenna output, in dBm, for the following conditions: a) A 1.5-m2 RCS target at a range of 20 km b) A 20-dBsm target at a range of 100 km.	CO4- App	(20)
2.	(a)	Explain how system losses will effect on the Radar Range.	CO2- U	(20)
		Or		
	(b)	Describe in detail about the sampling process of Radar signals in fast time dimensions. Also explain about the I/Q Imbalance and Digital I/Q.	CO2- U	(20)
3.	(a)	Apply the concept of matched filter characteristics to control the range side lobe in Radar system.	CO3- App	(20)
		Or		

	(b)	Apply the concept of costas frequency code to improve the performance of Radar in frequency domain.	CO3- App	(20)
4.	(a)	Describe the performance of a radar system which is useful in measuring velocity of a target accurately.	CO2- U	(20)
		Or		
	(b)	Illustrate the issues in Doppler Processing when considering moving platforms.	CO2- U	(20)
5.	(a)	A phased array radar searches a volume of space with a search raster containing 400 beams. The dwell time per beam is 10 ms. and the radar uses a pulsed Doppler waveform. The signal processor has 10 range gates with a 64-point fast Fourier transformer (FFT) on each range gate. This produces a 10-by-64 range-Doppler map on each dwell. The detection logic checks each range-Doppler cell once per beam dwell. We want the radar to support a 20-s time between false alarms. For purposes of computing Pd and Pfa , we consider a dwell a single sample, or single pulse. Thus, the Pd and Pfa equations of this chapter apply to this problem. a) What false alarm probability, Pfa , is necessary to support the specified false alarm rate? b) What SNR, in dB, is required at the signal processor output for the radar to provide a single-sample detection probability of 0.95 on a SW0/SW5 target? c) What SNR, in dB, is required at the signal processor output for the radar to provide a single-sample detection probability of 0.95 on a SW1 target? d) What SNR, in dB, is required at the signal processor output for the radar to provide a single-sample detection probability of 0.95 on a SW3 target?	CO4- App	(20)
		Or		
	(b)	Consider a weapon locating radar having a beam width of 2 degrees in both azimuth and elevation that is set up to search a volume defined by a 75 degree sector in azimuth and a 4 degree sector in elevation. If the radar also has a dwell time of 2.4 msec and a plan to spend 5 dwells at each beam location, what is the total scan time?	CO4- App	(20)