Reg. No.																

Question Paper Code	14273

M.E. / M.Tech - DEGREE EXAMINATIONS, NOV / DEC 2025

First Semester

M.E. - Communication Systems

24PCOEL102 - DIGITAL COMMUNICATION RECEIVERS

Regulations - 2024

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following modulation schemes uses two-dimensional signal space representation? (a) ASK (b) BPSK (c) QPSK (d) OOK	1	K1	CO1
2.	The main advantage of baseband transmission is _________. (a) Reduced bandwidth requirement (b) Simple modulation process (c) High noise immunity (d) Higher data rate	1	K1	CO1
3.	A matched filter provides maximum output SNR when ________. (a) Noise is white and Gaussian (b) Signal is deterministic and periodic (c) Channel is distortionless (d) Input power is minimum	1	K1	CO2
4.	The optimum decision rule in an AWGN channel is based on ________. (a) Maximizing the received signal energy (b) Minimizing the Euclidean distance between received and possible transmitted signals (c) Averaging all received samples (d) Selecting the signal with maximum amplitude	1	K1	CO2
5.	Orthogonal functions in digital communication help in ________. (a) Increasing antenna gain (b) Minimizing inter-signal interference (c) Improving analog bandwidth (d) Enhancing quantization	1	K1	CO3
6.	The probability of error for BPSK in AWGN channel is given by ___. (a) $Q(\sqrt{Eb/No})$ (b) $Q(\sqrt{2Eb/No})$ (c) $1 - Q(\sqrt{2Eb/No})$ (d) $\exp(-Eb/No)$	1	K1	CO3
7.	In Rayleigh fading, the amplitude of the received signal has ________. (a) Uniform distribution (b) Rayleigh distribution (c) Gaussian distribution (d) Rician distribution	1	K1	CO4
8.	Frequency-selective fading occurs when ___________. (a) Coherence bandwidth > signal bandwidth (b) Coherence bandwidth < signal bandwidth (c) Doppler shift = 0 (d) Channel is time-invariant	1	K2	CO4
9.	Symbol timing recovery ensures _________. (a) Frequency offset removal (b) Sampling at the correct instant (c) Carrier phase correction (d) Reduction in ISI only	1	K1	CO5
10.	The purpose of a decision-feedback equalizer (DFE) is to ________. (a) Remove white noise (b) Eliminate ISI from past symbols (c) Increase signal bandwidth (d) Correct carrier frequency offset	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	List the essential components involved in a baseband communication system.	2	K1	CO1
12.	Classify digital modulation techniques based on linearity.	2	K2	CO1
13.	Identify the function of a matched filter in an optimum receiver.	2	K2	CO2
14.	Define decision rule for Maximum likelihood detection.	2	K1	CO2

15.	Compute the probability of error for a BPSK system in AWGN using the Q-function.	*2*	*K2*	*CO3*
16.	Explain how fading influences the performance of digital modulation schemes.	*2*	*K2*	*CO3*
17.	Distinguish between flat and frequency-selective fading channels.	*2*	*K2*	*CO4*
18.	Outline the role of diversity techniques in improving receiver performance under fading.	*2*	*K2*	*CO4*
19.	Specify the need for carrier phase estimation in digital receivers.	*2*	*K2*	*CO5*
20.	Infer the process of symbol timing recovery using a timing error detector.	*2*	*K2*	*CO5*
21.	Compare the convergence characteristics of the LMS and Zero-Forcing algorithms.	*2*	*K2*	*CO6*
22.	State the main advantage of a Decision-Feedback Equalizer (DFE) over a linear equalizer.	*2*	*K1*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Explain the concept of signal space representation for digital modulation schemes. Illustrate with BPSK and QPSK.	*11*	*K2*	*CO1*
		OR			
	b)	Illustrate the spectral characteristics of ASK, FSK, and PSK and their bandwidth efficiency.	*11*	*K2*	*CO1*
24.	a)	With a neat diagram, explain the structure and operation of an optimum receiver for AWGN channel using a matched filter.	*11*	*K2*	*CO2*
		OR			
	b)	Derive the expression for probability of error in maximum likelihood sequence detection for binary signaling over AWGN channel.	*11*	*K2*	*CO2*
25.	a)	Summarize the performance of M-ary orthogonal signaling with diversity.	*11*	*K2*	*CO3*
		OR			
	b)	Illustrate the benefits of coding for Rayleigh fading channel with binary PSK modulation.	*11*	*K2*	*CO3*
26.	a)	Explain Rayleigh and Rician statistical models for characterizing fading channels.	*11*	*K2*	*CO4*
		OR			
	b)	Infer the performance of coded waveforms in frequency selective fading channels.	*11*	*K2*	*CO4*
27.	a)	Compare and justify the suitability of data-aided and non-data-aided synchronization methods for high-speed digital communication receivers.	*11*	*K2*	*CO5*
		OR			
	b)	Illustrate maximum likelihood and non-decision directed timing estimation methods with necessary equations.	*11*	*K2*	*CO5*
28.	a)	Explain adaptive decision-feedback equalizer for digital communication systems and justify the choice of adaptation algorithm, filter structure, and performance criteria.	*11*	*K2*	*CO6*
		OR			
	b)	Illustrate the operation of the Zero-Forcing equalizer. Explain how it removes ISI and explain its limitations in noisy channels.	*11*	*K2*	*CO6*