Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–III (NEW)• EXAMINATION – SUMMER 2017

Subject Code: 2730502 **Date:02/05/2017**

Subject Name: Advanced Digital Communication

Time:02:30 pm to 05:00 pm **Total Marks: 70**

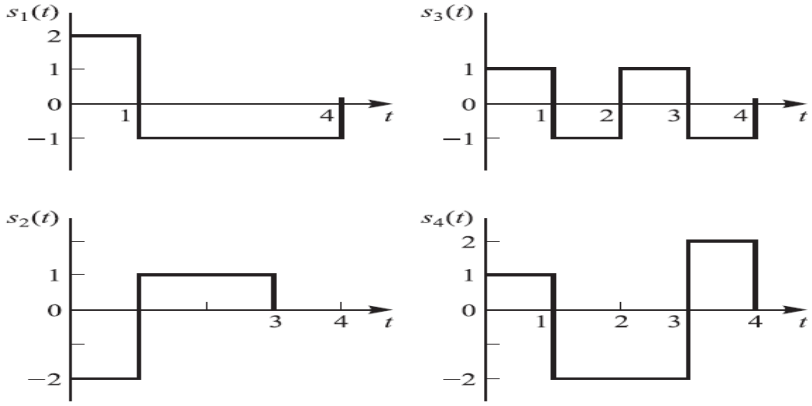
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define Hilbert transform. Prove the following properties of Hilbert transforms: (i) If x(t) = x(-t) then $\hat{x}(t) = -\hat{x}(-t)$, (ii) If x(t) = cos ω_0t then $\hat{x}(t) =$ sin ω_0t and (iii) If x(t) = sin ω_0t then $\hat{x}(t) =$ -cos ω_0t. **07**

(b) Write a short note on: (i) Continuous Phase FSK (CPFSK) and (ii) Continuous Phase Modulation (CPM). **07**

Q.2 **(a)** Consider the four waveforms shown in following figure: **07**



(i)Determine the dimensionality of the waveforms and a set of basis functions.
(ii)Use the basis functions to represent the four waveforms by vectors s_1, s_2, s_3, and s_4.
(iii) Determine the minimum distance between any pair of vectors.

(b) Explain the block diagram of Matched filter demodulator and also explain the properties of Matched filter. **07**

OR

(b) Explain the block diagram of Correlation type demodulator with necessary equation. **07**

Q.3 **(a)** Derive the expression of probability of error or BER for M-ary PAM signal. **07**

(b) Explain the block diagram of Optimum AWGN receiver in detail. **07**

OR

Q.3 **(a)** Explain Maximum-likelihood sequential detection (MLSD) in detail. **07**

(b) Explain the block diagram of carrier recovery circuit using a square law device. **07**

Q.4 **(a)** Based on Maximum-likelihood (ML) criterion, determine a carrier phase estimation method for binary on-off keying modulation. **07**

(b) Explain the block diagram of Costas loop with necessary equation. **07**

OR

Q.4 **(a)** Explain Nyquist criteria for zero Intersymbol Interference (ISI) with its proof. **07**

(b) Write a short note on: (i) Binary signaling with duobinary pulse and (ii) Four level signal transmission with duobinary pulse. **07**

Q.5	**(a)**	A voice-band telephone channel passes the frequencies in the band from 300 to 3300 Hz. It is desired to design a modem that transmits at a symbol rate of 2400 symbols/s, with the objective of achieving 9600 bits/s. Select an appropriate QAM signal constellation, carrier frequency, and the roll-off factor of a pulse with a raised cosine spectrum that utilizes the entire frequency band. Sketch the spectrum of the transmitted signal pulse and indicate the important frequencies.	**07**
	(b)	Explain decision feedback equalizer in detail.	**07**

OR

Q.5	**(a)**	Define CDMA with its capacity formula. Also justify the statement that the sum of rates of the K users goes infinity with K for FDMA and TDMA while it exceed in CDMA.	**07**
	(b)	Explain the block diagram of Orthogonal frequency division multiplexing (OFDM) technique in detail.	**07**

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