Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 1722202 **Date:23/05/2016**

Subject Name: Advanced Digital communication

Time:10:30 am to 01:00 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)** i)Define the following terms: Orthonormality, Anti-podality, Bi-orthogonal signal **03**

ii) What are cyclostationary processes ? **04**

(b) The pdf of a Cauchy distributed random variable X is $p(x) = (a/\pi) / (x^2 + a^2)$, where $-\infty < x < \infty$ **07**

i) Determine the mean and variance of X.

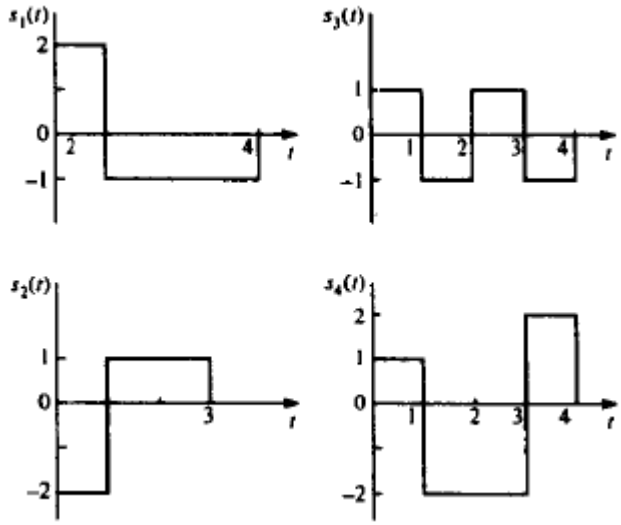
ii) Determine the characteristic function of X.

Q.2 **(a)** Explain any one Memory less modulation methods. **07**

(b) Discuss Gram-schmidt procedure for constructing a set of orthonormal Transforms. **07**

OR

(b) Consider the four waveforms shown below. **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 the vectors.

Q.3 **(a)** Explain the working of Correlation-type demodulator. **07**

(b) Consider the signal: $s(t) = (A/T)t \cos 2\pi f_c t \quad (0 \le t \le T)$ **07**

$= 0 \quad$ (Otherwise)

i) Determine the impulse response of the matched filter for the signal and find the output of the matched filter at t=T.

ii) Suppose the signal s(t) is passed through a correlator that correlates the input s(t) with s(t). Determine the value of correlator output at t=T.

OR

Q.3	**(a)**	How the Matched-Filter demodulator works? List out its properties.	**07**
	(b)	With the help of a block diagram explain the working principle of DPSK demodulator.	**07**
Q.4	**(a)**	Compare M-ary PAM receiver and QAM receiver.	**07**
	(b)	Consider the PLL for estimating the carrier phase of a signal in which loop filter is specified as $G(s) = K / (1+ \tau_1 s)$ i) Determine the closed-loop transfer function H(s) and its gain at f = 0 ii) For which range of values of τ_1 and K is the loop stable.	**07**

OR

Q.4	**(a)**	What are Non-Decision-directed loops? Explain with an example.	**07**
	(b)	Discuss two types of early-gate synchronizers with block diagrams	**07**
Q.5	**(a)**	State and prove Nyquist condition for zero ISI.	**07**
	(b)	A wireless channel of length 1000 Km is used to transmit data by means of binary PAM. Regenerative repeaters are spaced 50 Km apart along the system. Each segment has an ideal (constant) frequency response over the frequency band $0 \leq f \leq 1200$ Hz and an attenuation of 1dB/Km. The channel noise is AWGN. i) What is the highest bit rate that can be transmitted without ISI? ii) Determine the required E_b/N_o to achieve bit error of $P_2 = 10^{-7}$ for each repeater. iii) Determine the transmitted power of each repeater to achieve the desired E_b/N_o, when $N_o = 4.1 \times 10^{-21}$ W/Hz.	**07**

OR

Q.5	**(a)**	Describe an FFT based Multicarrier system.	**07**
	(b)	What are different frequency-nonselective, slowly fading channels?	**07**

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