Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER III (NEW) – EXAMINATION – WINTER-2016

Subject Code: 2730502 **Date:25/10/2016**

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.**

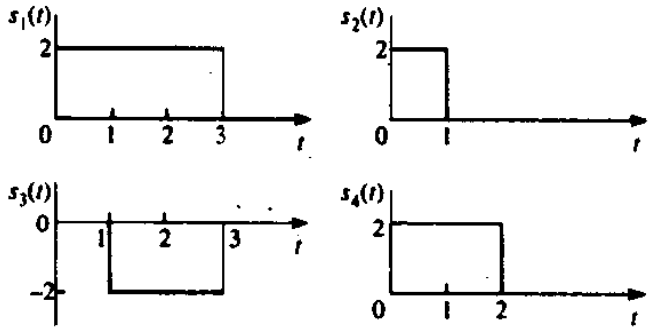
Q.1 **(a)** Explain representation of band pass signals and systems in terms of equivalent low pass waveforms. Also explain response of a band pass system to a band pass signal **07**

(b) Explain how Hilbert transform differs from Fourier transform. List out all properties of Hilbert transform. **07**

Q.2 **(a)** Following figure displays the waveforms of four signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$. **07**

a) Using the gram Schmidt orthogonalization procedure, find an orthonormal basis for this set of signals.

b) Construct the corresponding signal space diagram



(b) Explain Matched Filter with its properties. **07**

OR

(b) Consider the signal: **07**

$s(t) = (A/T)t \cos(2\pi f_C t)$; $(0 \le t \le T)$

$= 0$; (Otherwise)

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

ii) Determine the output of matched filter at t=T

iii) Suppose the signal is passed through a correlator that correlates the input, Determine the value of correlator output at t=T. Compare your result with that in (ii)

Q.3 **(a)** Draw signal Space Diagrams(for M=8) of **07**
(1) PAM (2) PSK (3) PAM-PSK (4) QAM and (5) CPFSK for h=1/2,2/3

(b) Evaluate the probability of error for M-ary PAM **07**

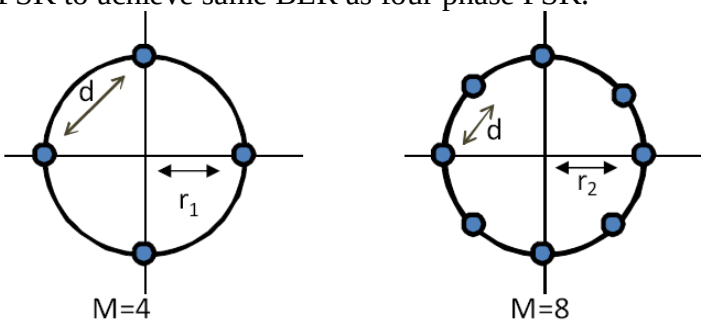
OR

Q.3 **(a)** What is simplex signal and bi-orthogonal signal? List out all properties of simplex and bi-orthogonal signals. **07**

(b) Compare MSK, Offset-QPSK and QPSK with reference to rectangular pulse of duration $0 \leq t \leq 2T$. **07**

Q.4 **(a)** With proper block diagram explain how in phase carrier recovery is done using Costas loop method. **07**

(b) Consider the four phase and eight phase signal constellation shown in figure below. Determine the radii r1 and r2 of circles such that the distance between two adjacent points in the two constellations is d. Also find additional energy required in 8 PSK to achieve same BER as four phase PSK. **07**



OR

Q.4 **(a)** State different types of nonlinear modulation methods with memory. Explain one of in detail. **07**

(b) Binary PAM signals have a two possible signal points are $s1=s2=\sqrt{\varepsilon_b}$, where ε_b is the energy per bit. The prior probabilities are P(s1)=p and P(s2)=1-p. Determine the metrics for the optimum MAP Detector when the transmitted signal is corrupted with AWGN. **07**

Q.5 **(a)** Write a short note on FFT based Multicarrier system. **07**

(b) State the Nyquist pulse shaping criterion (Nyquist condition for zero ISI), and prove it. **07**

OR

Q.5 **(a)** Write a short note on Orthogonal Frequency Division Multiplexing (OFDM). **07**

(b) Explain difference between decision directed and non-decision directed loops. **07**

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