Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – IInd - Examination – June/July- 2011

Subject code: 1722202

Subject Name: Advanced Digital Communication

Date:24/06/2011 **Time: 10:30 am – 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)** Classify Stochastic Process. **07**

(b) Compare Hilbert Transform with Fourier Transform. **07**

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

(b) Two Functions $s_1(t)$ and $s_2(t)$ are given in fig 1.Here the interval of interest extends from t=0 to t=T. Using Gram-Schmidt procedure express these functions in terms of Ortho-normal components. **07**

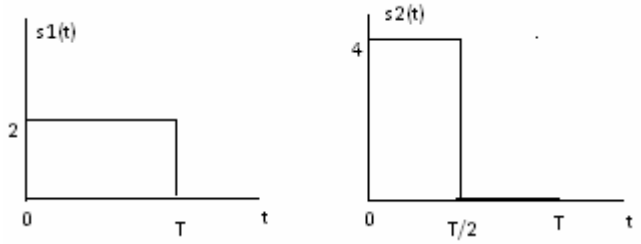

Fig.1

OR

(b) A Low-pass Gaussian stochastic process x(t) has a power spectral density **07**

$$\Phi(f)=\{ N_0 \ (|f|<B), \quad 0 \ (|f|>B) \}$$

Determine power spectral density and auto correlation function of $y(t)=x^2(t)$.

Q.3 **(a)** Compare MSK with offset QPSK with reference to signal waveforms and power density spectra. **07**

(b) Explain properties of the Matched filter. **07**

OR

Q.3 **(a)** 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 $P(s_1)=p$ and $P(s_2)=1-p$.Determine the metrics for the optimum MAP Detector when the transmitted signal is corrupted with AWGN. **07**

(b) The random process v(t) is defined as **07**

$$v(t)=X\cos 2\pi f_c t-Y\sin 2\pi f_c t$$

Where X and Y are random variables. Show that v(t) is a wide-sense stationary if and only if $E(X)=E(Y)=0, E(X^2)=E(Y^2)$, and $E(XY)=0$

Q.4	**(a)**	Compare several Digital Modulation methods at 10^{-5} symbol error probability.	**07**
	(b)	Digital information is to be transmitted by carrier modulation through an additive Gaussian noise channel with a bandwidth of 100kHz and $N_0=10^{-10}$W/Hz. Determine the maximum rate that can be transmitted through the channel for 4 phase PSK, binary FSK, four-frequency orthogonal FSK, which is detected non-coherently.	**07**

OR

Q.4	**(a)**	Determine the joint ML estimate of τ and $\varnothing$ for PAM signal.	**07**
	(b)	A Speech signal is sampled at a rate of 8 kHz, logarithmically compressed and encoded into a PCM format using 8 bits per sample. The PCM data is transmitted through an AWGN baseband channel via M-level PAM. Determine the Bandwidth required for transmission when (a) M=4 (b) M=8 (c) M=16.	**07**
Q.5	**(a)**	Compare decision directed with non-decision directed Phase-locked loop.	**07**
	(b)	Explain Orthogonal Frequency Division Multiplexing (OFDM).	**07**

OR

Q.5	**(a)**	Explain Early-late gate synchronizers.	**07**
	(b)	Explain significance of parallel Transmission under fading channel.	**07**

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